Engineering Library

MAY 5 1925

With METALLURGICAL SUPPLEMENT.

The Engineer.

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The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

Metallurgical Supplement.

The British Steam Railway Locomotive from 1825 to 1924—No. 17.

The United States and Rigid Airships.

The Motor Ship Raby Castle.

Irrigation Enterprises in Australia.

New Italian Scouts.

Automatic Railway Signal Installation.

Recent Oil Engine Developments.

The Sale of Coke by Analysis.

Chain Link Making Machine.

PUBLIC NOTICES

The Director - General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for—

1. STEAM COALING CRANES, 2-Ton.
2. STEEL BOILER TUBES, Solid Drawn.
3. CONCRETE BLOCK YARD PLANTS:
   (a) Goliath Cranes.
   (b) Mixer Gantries with Tip Wagons.
   (c) Bunkers with Elevators, Hoppers, &c.
   (d) Travelling Inclined Planes for Raising Tip Wagons.
4. Electrically Driven PUMPING UNITS, Mounted on Pontoons for De-watering Cofferdams:
   (a) Pontoons with Covering and Stays, Gantries, &c.
   (b) Centrifugal Pumps, 8in.
   (c) Squirrel Cage Motors, with Control Gear.
   (d) Delivery and Suction Pipes, Valves, &c.

Tenders due on the 5th May, 1925, for Nos. 1 and 2, and on the 7th May, 1925, for Nos. 3 and 4. Tender forms obtainable from above. 9013

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Wednesday, 13th May, 1925, for the INSTALLATION of LOW-PRESSURE HOT WATER HEATING at Colwyn Bay Post Office.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities and forms for Tender, &c., may be obtained from the Contracts Branch, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners of H.M. Works, &c.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 9025

Architect Required by the GOVERNMENT of NIGERIA for the Public Works Department for two tours of not less than 12 nor more than 18 months' service. Salary £480 a year for the first 3 years of service and then £510, rising by £30 to £720 a year, and thence rising by £40 to £800 a year. Free passages and quarters and liberal leave on full salary. Outfit allowance £60 on first appointment. Candidates, aged 25-35, must have had experience in hospital and general building work and preferably be A.R.I.B.A. or hold equivalent professional qualifications.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/13,507. 8974

Assistant Engineers (3) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT, for two tours of not less than 12 nor more than 18 months' service, with possible extension. Salary £480 a year for the first three years of service, then £510, rising to £720 a year by annual increments of £30, and thereafter to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment. Free quarters and passages, and liberal leave on full salary. Candidates, aged 25 to 30, preferably unmarried, must have had good general education and be (a) A.M.I.C.E. or hold equivalent qualifications, or (b) have passed the full examination of the Institution of Municipal and County Engineers. They must have had proper technical training, and have had not less than two years' subsequent experience in Large Engineering or Municipal Works.—Apply at once by letter, stating age, qualifications and experience, also whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting reference M/13,422. 8998

Civil Engineers Required by the GOVERNMENT of CEYLON for appointment as Irrigation Engineers for three years in the first instance. Salary £500, rising to £900 a year by annual increments of £40 (£600 on attaining 30 years of age). Free passage provided. Candidates, preferably unmarried, age 26 to 31, must have passed the examinations to qualify for Associate Membership of the Institution of Civil Engineers or hold equivalent professional qualifications, and have had at least three years' practical experience on waterworks, drainage, or harbour and dock works.—Apply at once by letter, stating whether married or single, age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting at head of application M/13,342. 8975

Civil Engineers (2) Required by the GOVERNMENT of the GOLD COAST for the PUBLIC WORKS DEPARTMENT for two tours of from 12 to 18 months' service each. Free passages and quarters and liberal leave on full salary. Outfit allowance of £60 on first appointment. Salary £480 for the first three years of service and then £510, rising to £720 by annual increments of £30 and thence rising to £920 by annual increments of £40. Candidates, aged 25-35, preferably Associate Members of the Institution of Civil Engineers, should be good surveyors and have had considerable experience in practicable town planning and be conversant with Ministry of Health procedure on town planning.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/13,510. 8993

Sanitary Engineer Required by the GOVERNMENT of the TANGANYIKA TERRITORY, for the PUBLIC WORKS DEPARTMENT. Salary, £700, rising to £800 a year by annual increments of £25, to be engaged in the first instance for a tour of 30-36 months' service with prospect of the appointment becoming permanent after two years of service if re-engaged for the second. Free quarters and passages, and liberal leave on full salary. Candidates, not over 40 years of age, must be Associate Members of the Institution of Civil Engineers or hold equivalent professional qualifications, and have had at least 5 years' experience in the actual charge of the Construction and Maintenance of Water and Sewage Works. Must be fully conversant with the latest methods of Mechanical Filtration, and be capable of carrying out detailed plans and estimates in connection with Water Supply and Sewage Schemes, both Gravitation and Pumping.—Apply at once by letter, stating age, and giving brief details of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, S.W. 1, quoting M/13,440 9014

PUBLIC NOTICES

Section Engineers (4) REQUIRED for the CONSTRUCTION BRANCH of the FEDERATED MALAY STATES RAILWAYS, for three years' service, with possible extension. Salary 400 dollars a month, rising to 475 dollars a month by annual increments of 25 dollars a month, plus a temporary non-pensionable allowance of 10 per cent., which is liable to cancellation or revision, plus a commuted field allowance of 50 dollars a month. The exchange value of the dollar, in sterling, is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is at present considerably less than that of 2s. 4d. in the United Kingdom. Free passages provided. On expiration of agreement a bonus of four and a half months' salary may be allowed, provided the work and conduct of the person engaged has been in every way satisfactory. Candidates, age 22 to 35, unmarried, must have served an Engineering Apprenticeship on a Home Railway, preferably possess some subsequent experience on Railway Construction and Maintenance, and have passed examination to qualify for Associate Membership of the Institution of Civil Engineers, or hold equivalent professional qualifications.—Apply at once by letter, stating age and particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting at top of application M/13,264. 8999

G. R.

For Disposal by Tender, 40,000 TONS (EX GERMAN) FLOATING DOCK No. 23.

The ADMIRALTY have FOR DISPOSAL without restriction as to use abroad the above-mentioned DOCK, lying in sections at Chatham.

Brief particulars of the Dock are as follows:—

Lifting capacity	40,000 tons
Length overall	702ft. 9in.
Breadth	194ft.
Breadth to outside walls	183ft. 10in.
Width inside at top of walls	154ft. 2in.
Width inside at bottom of walls	147ft. 10in.
Minimum inside width (between fenders)	147ft. 2in.
Length of M.L. keel blocks	700ft.
Height of blocks	4ft. 3in.
Maximum draught of ship dockable, about	36ft.
Depth of water required at site to dock ship of 36ft. draught	63ft. 6in.
Time for lifting large ship	2-3 hours

The sections of the Dock are for sale as and where they lie and without any guarantees. Further particulars, Tender forms, conditions of sale, &c., together with an order to view, may be obtained upon application to the DIRECTOR of NAVY CONTRACTS, Admiralty, Room 62, Prince's House, Kingsway, London, W.C.2.

Sealed Tenders are due at the Admiralty by Noon on Tuesday, the 12th May, 1925. 8921

Bombay, Baroda, and Central INDIA RAILWAY COMPANY.

The Directors are prepared to receive up to Noon on Friday, 8th May, TENDERS for the SUPPLY of:—

(1) HELICAL and VOLUTE SPRINGS.
(2) LAMINATED and ELLIPTICAL SPRINGS.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of 20s. each (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG,
Secretary.

Offices: 91, Petty France, Westminster, S.W. 1,
20th April, 1925. 8989

PUBLIC NOTICES

Richmond Main Sewerage Board CONTRACTS FOR STORES.

The Board are prepared to receive TENDERS for the SUPPLY and DELIVERY to their works during the year ending May 31st, 1926, of the following STORES:—

STEAM COAL (WELSH).
GREY LIME.
BUXTON LIME.
SEWAGE PRECIPITANTS.
FILTER PRESS CLOTHS.

Specifications may be inspected and further particulars obtained on personal application only at the office of Mr. William Fairley, M. Inst. C.E., Engineer to the Board, West Hall-road, Kew Gardens, Surrey.

Sealed Tenders, on the forms provided, to be delivered to the undersigned on or before Tuesday, May 12th, 1925.

The Board do not bind themselves to accept the lowest or any Tender.

WM. MERRICK,
Clerk to the Board.

The Sessions House, Richmond, Surrey,
15th April, 1925. 8957

The South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of:—

110 METRE-GAUGE BOGIE STEEL HIGH-SIDED WAGONS.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Wagons," must be left with the undersigned not later than Twelve Noon on Friday, the 19th June, 1925.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of £1 for each copy of the specification.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, of 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, S.W. 1,
18th April, 1925. 8990

Wigan Union.

The Guardians of the Poor of the Wigan Union invite TENDERS for the SUPPLY, DELIVERY and ERECTION of ONE ELECTRICAL VERTICAL PUMPING PLANT, HEATING and DOMESTIC HOT WATER SUPPLY APPARATUS, ALTERATIONS of BUILDINGS, ADDITIONS, and MAKING a WELL at the Poor Law Infirmary, Billinge, near Wigan.

Copies of the specification and general conditions may be obtained from me, the undersigned, on payment of a fee of £3 3s., which will be returned upon receipt of a bona fide Tender, and plans can be inspected at this office at any time during office hours.

Tenders, to be sealed and endorsed "Tender for Plant, Billinge Infirmary," to be delivered to me not later than 4 p.m. on Monday, the 25th May, 1925.

The Guardians do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
H. GORDON ACKERLEY,
Clerk.

Victoria Buildings, King-street, Wigan,
20th April, 1925. 8972

PUBLIC NOTICES

City of Leicester. STORM WATER AND SEWAGE DISPOSAL WORKS, CONTRACT NO. 4.

CAST IRON PIPES AND OTHER IRONWORK.

The Leicester Corporation are prepared to receive TENDERS for the SUPPLY and DELIVERY of CAST IRON PIPES, BENDS, BRANCHES, SPECIAL CASTINGS, and SLUICE VALVES for RISINGS MAINS and for other IRONWORK in connection with Sewage Disposal Works.

The Contract is divided into the following sections:
Section A.—Cast Iron Pipes.
Section B.—Cast Iron Pipe Specials.
Section C.—Sluice Valves, Wall Penstocks, Floating Arms, &c.
Section D.—Automatic Revolving Sewage Distributors.

Tenders may be submitted for any or all of the items.

Copies of the conditions of contract, specification, bill of quantities, with form of Tender, &c., may be obtained at my office on and after 20th April, 1925, on payment of the sum of £2, which will be returned on receipt of a bona fide Tender.

Cheques, &c., to be crossed and made payable to the Leicester Corporation.

Sealed Tenders, together with the summary of Tender on the forms supplied, filled up and addressed to "The Chairman of the Sewage Works and Farms Committee, Town Hall, Leicester," are to be delivered not later than 9 a.m. on 9th May, 1925, endorsed "Tender for Cast Iron Pipes and other Ironwork."

The Corporation do not bind themselves to accept the lowest or any Tender.

E. GEORGE MAWBEY, M. Inst. C.E.,
City Engineer and Surveyor.

Town Hall, Leicester,
April, 1925. 8951

Port of Bristol. RECONSTRUCTION OF SHED "V." BRISTOL.

The Docks Committee invite TENDERS for the RECONSTRUCTION, mainly in Ferro-concrete, of the Double-floor TRANSIT SHED known as Shed "V," situate on Canon's-road, Bristol.

On and after Friday, the 1st May, 1925, a copy of the form of Tender, general conditions, specification, schedule of prices, and a copy of the contract drawings can be obtained from the undersigned on production of a receipt showing that a deposit of £5 has been paid to the General Manager and Secretary of the Bristol Docks Committee, to whom all cheques must be made payable. The deposit of £5 will be returned hereafter to all bona fide tenderers.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for the Reconstruction of Shed 'V,' Bristol," addressed to the General Manager and Secretary of the Docks Committee, 10, Queen-square, Bristol, and must be delivered to him, accompanied by all the prescribed documents and drawings, before 10 a.m. on Monday, the 1st day of June, 1925.

The Docks Committee do not bind themselves to accept the lowest or any Tender.

THOMAS A. PEACE,
Chief Engineer,
Port of Bristol.

Chief Engineer's Office, Avonmouth Docks,
24th April, 1925. 8988

The Great Indian Peninsula RAILWAY COMPANY, 48, Copthall-avenue, London, E.C. 2, invite TENDERS for—

1.	LAMINATED SPRINGS ..... Fee	10s.
2.	HELICAL SPRINGS and VOLUTE SPRINGS	10s.
3.	ROLLED STEEL DISC WHEELS and AXLES	£1
4.	CRANK AXLES (Machined) for Loco. Engines	5s.
5.	AXLE-BOXES	10s.
6.	STEEL TYRES for Loco. Engines and Tenders	10s.
7.	POINTS and CROSSINGS (I.)	10s.
8.	POINTS and CROSSINGS (II.)	7s. 6d
9.	LINOLEUM	5s.
10.	COPPER TUBES, BRASS SHEETS, &c.	10s.
11.	COPPER PLATES and RODS and PHOSPHOR COPPER	10s.
12.	STEEL WORK for BRIDGES	10s.
13.	SOLID - DRAWN STEEL BOILER TUBES	10s.
14.	WOOD HANDLES	7s. 6d.
15.	YORKSHIRE IRON	10s.
16.	MILD STEEL BARS, SECTIONS, &c., for Misc. Purposes	10s.
17.	CARRIAGE UNDERFRAMES with Steel Bodies and Four-wheel Bogies	£1

Tenders for Nos. 1 to 16 are due by 11 a.m. on 5th May, 1925. Tenders for No. 17 (Underframes) are due 11 a.m. on 19th May. Tender forms obtainable at above address. Fees not returnable. 9001

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PUBLIC NOTICES

Broadstairs and St. Peter's

URBAN DISTRICT COUNCIL.
WATERWORKS DEPARTMENT.
ENGINEER-IN-CHARGE.

The Council invite APPLICATIONS for the APPOINTMENT of ENGINEER-IN-CHARGE of their pumping station at St. Peter's.

Applicants must be competent to Take Charge of the recently erected Pumping Plant, which includes Vertical Oil Engines, Deep-well Pumps, Softening Apparatus, &c., and have had practical workshop experience, as the person appointed will be responsible for carrying out all running repairs. Salary £20 16s. 8d. per month.

Applications, which must be made on prescribed form obtainable from the undersigned, should reach me not later than Mid-day on the 11th May, 1925.

L. A. SKINNER,
Clerk of the Council.

Pierremont Hall,
Broadstairs,
16th April, 1925. 8997

Burma Railways.

CIVIL ENGINEER.

The Directors are prepared to receive APPLICATIONS from properly qualified candidates for APPOINTMENT as ASSISTANT ENGINEER (Bridge Engineer) for service on the Company's railway in Burma.

Candidates should be between 25 and 30 years of age, active, and of good physique. They must possess a thorough knowledge of girder design and manufacture, and have had a good theoretical training in engineering knowledge at a recognised engineering college.

Particulars should be given as to whether applicants have had any outside experience of the erection or renewal of bridges either at site or in a bridge builder's yard.

SALARY.—Scale: Rs. 550, with annual increments of Rs. 50 to Rs. 1100 per calendar month. The commencing salary on appointment will be according to age and experience; if 25 years of age, Rs. 650; if 30, Rs. 800.

TERMS.—A three years' agreement in the first instance, first-class free passage to Burma, and home again on satisfactory termination of services.

The selected candidates will be required to pass a strict medical examination by the Company's Consulting Physician before appointment.

Applications (by letter only), giving particulars of applicants' general and technical education and training, and showing in chronological order (with dates) where and how they have been employed from time to time, should be addressed to the undersigned to be received not later than Wednesday, 13th May, 1925.

THE MANAGING DIRECTOR,
199, Gresham House,
Old Broad-street, E.C. 2.
8976

The South Metropolitan Gas

COMPANY has a VACANCY for an ENGINEER with wide experience in the design, construction, erection and repair of gasholders, retort and other manufacturing plant and structures of the kind used in Gas Works and Coke Oven Recovery.

Applications, giving age, full particulars of qualifications, experience, military service, and salary required, should be made in writing to the undersigned before 9th May, 1925.

By Order,
FRANK DAY,
Secretary.

709, Old Kent Road,
London, S.E. 15.
20th April, 1925. 8963

Warwickshire County Council

TEMPORARY ENGINEERING ASSISTANT.

APPLICATIONS are INVITED for the above APPOINTMENT, at a salary of £6 to £8 per week, according to experience.

Candidates must have a thorough knowledge of the Designs and Construction of Reinforced Concrete Bridges, Surveying and Levelling.

The appointment will probably be for a period of at least twelve months.

Applications, stating age, qualifications, salary required, and when able to start duties, accompanied by copies of two recent testimonials, must be delivered to the undersigned as soon as possible, but not later than the 5th May, 1925.

D. H. BROWN,
County Surveyor.

County Surveyor's Office,
8, Northgate-street, Warwick,
April 22nd, 1925. 9020

SITUATIONS OPEN

WANTED, an Up-to-date ASSISTANT for WORKS MANAGER, age between 30 and 35. Must be familiar with latest Machine Shop Practice and capable of effectively reducing costs of manufacture. Factory is situated in Birmingham area. Write, stating age, experience, and salary required; all communications treated with the strictest confidence.—Address, 8981, The Engineer Office. 8981 A

WANTED for an Engineering Shop in Leicester, a WEIGHT ESTIMATOR; must be fully capable of understanding General Engineering Drawings.—Address, stating wages required and experience, 9002, The Engineer Office. 9002 A

WANTED, Trained ENGINEER for Inside Sales Department of Manufacturing Firm in Manchester district. Must have knowledge of languages—German essential. Age 23-28.—Address, giving fullest particulars as to age, experience, and wage required, 8982, The Engineer Office. 8982 A

APPRENTICES.—Well-known GENERAL ENGINEERING COMPANY in East Anglia has OPENING for a few smart well-educated YOUTHS as APPRENTICES. The period of training is apportioned to the various workshops and drawing-office. Graduated scale of wages. Moderate premium.—Address, 8924, The Engineer Office. 8924 A

ASSISTANT (Man or Woman) to SECRETARY of Scientific Association REQUIRED. Must have university or equivalent higher education and considerable commercial office experience, and be capable of rapid work, systematic filing and organisation of records, and co-operation with other clerical staff. Some of the following experience or knowledge would be advantageous:—Languages (German and French), shorthand, technical journalism, engineering, chemistry or metallurgy. Salary (non-resident) about £250, according to experience. Location, country town about 30 miles from London.—Address, stating age and giving tabulated details of experience, with specimen of own handwriting, 8960, The Engineer Office. 8960 A

ENGINEER SALESMAN REQUIRED in London; one with good knowledge of Fuel Combustion, and preferably experience in the sale of CO_2 Recorders. Only those having undeniable qualifications as salesmen need apply. Good salary and commission offered to the right man.—Applicants should give full particulars of their experience, which will be treated in strict confidence, and address applications to JAMES GORDON, Esq., Windsor House, Kingsway, London, W.C. 2. P511 A

MAN REQUIRED to Take Charge of Progress Department in Engineering Works about 30 miles from London; only those who have had considerable experience with repetition work and know how to get things done need apply. State age, experience and salary.—Address, 9006, The Engineer Office. 9006 A

Edward Arnold & Co.'s Book List.

REINFORCED CONCRETE DESIGN.

Vol. I.—Theory. By OSCAR FABER, D.Sc., M. Inst. C.E., Chartered Consulting Engineer, and P. G. BOWIE, M. Inst. C.E. 14s. net.

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By S. W. PERROTT, M.A.I., M. Inst. C.E., Professor of Civil Engineering in the University of Liverpool, and F. E. G. BADGER, A.M. Inst. C.E. 140 Diagrams. 30s. net.

STEAM POWER.

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The Times Engineering Supplement.—"Can be fully recommended not only as a work of reference, but also as a treatise that will enable the reader to gain a mastery over the subject."

London: EDWARD ARNOLD & CO., 41 and 43, Maddox Street, W. 1.

SITUATIONS OPEN (continued)

REQUIRED, CONTRACTOR'S AGENT, with Good knowledge of Gas and Water Pipe Laying, capable of taking full charge of new and repair work. Must be fully experienced in dealing with first-class work and a good organiser. Permanent appointment to right man.—Address applications, stating experience, salary required, and copy of testimonials, 8978, The Engineer Office. 8978 A

R. Y. PICKERING and CO., Ltd., Railway Carriage and Wagon Builders, Wishaw, near Glasgow, have VACANCY for a WORKS MANAGER of sound technical, engineering and drawing-office experience, fully conversant with the manufacture of Railway Carriages and Wagons in all its branches, good organiser, able to control labour.—Apply, stating age, qualifications, salary required, when at liberty, and forward copies of recent testimonials, to JOHN ALSTON, Esq., Municipal Buildings, Coatbridge, Lanarkshire. 8942 A

SELLING ENGINEER REQUIRED by important Firm of British Oil Engine Manufacturers for Marine Sales in the British Isles; sound knowledge of Marine Engines and Conditions essential; good connection with shipowners, shipbuilders, naval architects, marine superintendents, &c., necessary. Excellent prospects to energetic representative with personality and initiative.—Address, 9018, The Engineer Office. 9018 A

SHIPYARD and ENGINEERING WORKS MANAGER REQUIRED for abroad (Servia), to take full technical charge of small composite undertaking capable of considerable development. Must be a trained practical man, capable of conducting and directing Ship Repair and Construction, Mechanical Engineering, Foundry, and kindred work in all its details. A good organiser and energetic. A knowledge of German is essential.

Address, giving full resume of training and experience, salary required, &c., P487, The Engineer Office. P487 A

WORKS MANAGER WANTED, to Take Charge of High-class Instrument Making Factory. Good prospects for capable man. Unfurnished flat available.—Address, P517, The Engineer Office. P517 A

WANTED, FIRST-CLASS DRAUGHTSMAN as Section Leader for Light Steel Structural Work and Conveying Plant; must be quick and accurate and capable of making all necessary calculations, and carrying out designs without supervision.—Apply, stating age, experience and qualifications, Address, "STRUCTURAL," Wm. Porteous and Co., Glasgow. P527 A

WANTED IMMEDIATELY, DRAUGHTSMAN, accustomed to Water-tube Boiler Plant Layout and Design.—Reply, stating experience and salary required, to Box No. 775, Advertising Offices, 84, Queen Victoria-street, London, E.C. 4. 8995 A

WANTED in Manchester District, CRANE DRAUGHTSMAN, with first-class experience. Only those who are capable of undertaking Original Work on Production Lines need apply. State age and salary required.—Address, 9019, The Engineer Office. 9019 A

WANTED, JIG and TOOL DRAUGHTSMAN for East Midland district.—Write, stating full particulars of age, experience, and salary required, to B.K., Box 1068, Willing's, 30, King-street, Covent Garden, W.C. 2. 8991 A

WANTED, First-class JIG and TOOL DRAUGHTSMAN; man with all-round experience.—Address, with references, stating age, &c., 8984, The Engineer Office. 8984 A

CIVIL ENGINEER DRAUGHTSMAN REQUIRED for Resident Engineer's Office on Railway in Chile; must be single, and have had sound Engineering Training with Drawing-office experience. A few years' pratical experience essential. Three years' contract; free passage out and home; free quarters provided. Salary to commence £300 per annum.—Write, with full particulars, to "D. D." c.o. Charles Barker and Sons, Ltd., 31, Budge-row, E.C. 4. 9024 A

DRAUGHTSMEN.—BEFORE NEGOTIATING with Government Departments in connection with any post, PLEASE COMMUNICATE with the GENERAL SECRETARY, Association of Engineering and Shipbuilding Draughtsmen, 96, St. George's-square, London, S.W. 1. 6769 A

SITUATIONS OPEN (continued)

DRAUGHTSMAN (Constructional) REQUIRED in the Midlands, used to designing Heavy and Light Constructional Work. Only first-class men need apply. State age, experience, and salary required.—Address, 8963, The Engineer Office. 8963 A

DRAUGHTSMAN (JUNIOR) REQUIRED in City Office of London Engineers, for General Elevators and Conveyors in Warehouses, Factories, Stores, &c.—Address, stating age, experience, salary required, 9003, The Engineer Office. 9003 A

DRAUGHTSMAN REQUIRED by Engineering Firm in City; used to Piping Lay-outs. Only experienced man need apply. State age, salary required and experience.—Address, 9021, The Engineer Office. 9021 A

DRAUGHTSMAN REQUIRED. Must be Skilled man, used to Electric Lift Lay-outs.—Apply by letter to CHIEF DRAUGHTSMAN, The Express Lift Co., Ltd., 9, Greycoat-street, S.W. 1. P533 A

DRAUGHTSMAN, Skilled in Design and Lay-out of Mechanical Handling Plants for Ore and Coal. Men without actual experience need not apply. State age, experience and salary required.—Address, 9022, The Engineer Office. 9022 A

DRAUGHTSMAN.—WANTED AT ONCE in London, DRAUGHTSMAN, used to Steam Pipe Arrangements, with good general knowledge of Engineering.—Write, stating experience and salary required, to Box 114, at Horncastle's, 60, Cheapside, E.C. 2. P520 A

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"THE ENGINEER" WANTED.

REQUIRED, "THE ENGINEER," dated OCTOBER 5th, 1917; must be complete. State price.—Address, 1000, The Engineer Office. 1000

For continuation of Small Advertisements see page 3.

A Seven-Day Journal

Dredging for Tin in Cornwall.

AN innovation in the tin-mining industry of Cornwall was made on Saturday, the 18th, when a 200-ton dredger was launched at Goss Moors, near Roche. Dredgers are, of course, used extensively for winning tin in other parts of the world, but this is the first attempt to use the principle in Cornwall. The dredger is owned by the British Alluvial Tin Syndicates, Ltd., and is to be used to work over an area of some 1000 acres leased from Lord Falmouth. It is said that the ground contains about 70 per cent. of concentrates, and that the area to be worked should yield some 7000 tons, estimated to be worth at the present time £140 a ton. The dredger is of the bucket type, and will be capable of handling 3 tons of spoil a minute. It is to be equipped with 16,000 square feet of dressing tables, and will be driven by three 80 horse-power engines.

Industry and Employment.

A MEMORANDUM upon the economic position of Great Britain has been drawn up by a number of influential members of the Industrial Institute and submitted to the Council of the Institute for consideration. The memorandum is not throughout as lucid as we could desire, but we gather that the signatories are of opinion that in directing the flow of investment, consideration should be given to the special problem of unemployment, with a view to the development of such industries as can add, quickly, to employment. We quote a passage from the memorandum, and leave the interpretation of it to our readers: "Is it possible that, in addition to, or instead of, devoting a small percentage of our available national resources to the development of certain industries on the ground that they can, immediately, employ labour, notwithstanding the fact that investment in them is not immediately attractive to the private investor, a corresponding amount, under similar expert advice, might be invested in industries, which, though not immediately attractive to the private investor, might yet correct a certain lack of balance in industrial development which arises from unco-ordinated activities, and produce results in regularity of employment much more than proportionate to the sum thus invested?" It is suggested that a committee of the Institute might be set up to consider and report upon "those contemporary tendencies in industry which appear to tend towards orderly, co-ordinated effort as distinguished from unco-ordinated, unlimited competition."

A New Cruiser Completed.

ON Tuesday last H.M.S. Effingham left Portsmouth for sea trials, after which she will go to the East Indies station to replace the Chatham, and to take over the duties of flagship. The Effingham was laid down as long ago as April 2nd, 1917, at Portsmouth Dockyard, and was launched in June, 1921. She has been regarded as a stand-by job since the war, and it was not until the present year that a sufficient sum was provided under the Navy Estimates to complete her for service. The new cruiser is the last of the improved "Birmingham" class, and has a normal displacement of over 9750 tons. Her overall length is 605ft., and she has a beam outside the bulges of 65ft., and a mean draught of 17¼ft. The turbine propelling machinery was built by Harland and Wolff, and is of the four-screw Brown-Curtis type, designed for an output of 65,000 shaft horse-power, which corresponds to a designed speed of about 30.5 knots. Small tube Yarrow type boilers are fitted. The Effingham was once referred to in the House of Commons as his Majesty's ship Methuselah, and Mr. Ammon, then the Under-Secretary for the Admiralty, pointed out that even eight years would be a short time for the building of a vessel which would have such a long life as that name implied.

Railway Accidents.

Two accidents to goods trains have happened during the last few days, one, unfortunately, with fatal results. A heavy goods train was going from Barnetby to Ashton Moss, near Oldham, and was passing along the avoiding line which skirts the western side of Doncaster, when it was held up by the signal. On the engine being restarted, it appears that the coupling between the seventh and eighth wagons parted, and the rear part of the train, comprising some thirty wagons laden with hay and seed potatoes, ran back down a slope, starting with a gradient of 1 in 120. Further back down the line at Sprotborough Junction a mineral train from Immingham was standing, and the runaway trucks ran, head on, into its engine. In the brake van of the first train there were the guard and three other railwaymen, and of these men three were killed outright, while the fourth was badly injured. The driver and fireman of the mineral train fortunately saw that a collision was inevitable, and jumped clear in time. It is noteworthy that the only damage to the locomotive was the smashing of a buffer and a brake. The other accident happened near Taunton and was caused by a train running through a stop block. The engine and several trucks fell down an embankment and wrecked a hut in which a railway employee was having breakfast, but he escaped without serious hurt. The wreckage, however, fouled the Exeter to Banbury line, and very shortly afterwards a goods train ran into it, with the result that a large number of trucks were damaged, and the line was blocked for some time. The driver and fireman of the wrecked engine jumped clear, and escaped with a shaking.

A French Lighthouse for Aircraft.

ON Saturday last the first of a series of powerful lighthouses which will mark the air route for the Paris–Algiers, Italy and Swiss aircraft was placed in commission. It is situated on Mont Afrique, near Dijon, at a height of about 1800ft. above sea level. The light is reported to be of 874,000,000 candle-power, and is arranged to give a double beam flash every five seconds. It is estimated that on a clear night the beam, which is more than thirty times as powerful as those from the Grisnez and Ushant lighthouses, will be visible at a range of 300 miles, whilst in dull weather it will carry over 100 miles. A similar lighthouse is to be constructed near Paris. When completed, this chain of French lighthouses will mark an important step towards making the international air routes available for long-distance night flying. Lighthouse have been used between Croydon and the coast for this purpose, but so far, we believe, no lighthouse so powerful as that near Dijon has been built for aeronautical service.

British Electrical Development Association

AT the annual luncheon of the British Electrical Development Association held at the Hotel Cecil on Friday, April 17th, speeches were delivered by several men eminent in the electrical industry. Sir George Sutton, the President, who occupied the chair, said that if the people of this country were well informed as to what electricity could do for them, and if they understood the convenience and economy of electrical services, he saw no reason why the use of electricity should not become general. The British Electrical Development Association had done good work, and in continuing and extending its propaganda, it should have the co-operation of all concerned. In proposing the toast of the Association, Mr. Frank Gill said that the Association spent £33,000 on the exhibit at Wembley, but the public had yet to be fully convinced of the value of electricity. Mr. A. F. Berry, the first President of the Association, said that the industry had about £500,000,000 invested in it, and within a few years that sum would be doubled or trebled. It was sometimes said that electricity was too dear, but as a matter of fact it was the cheapest domestic servant in existence.

Transatlantic Wireless Telephony.

THE Postmaster-General desires it to be understood that, contrary to recent statements, the wireless telephony experiments now being undertaken between England and America, are not based on a new and secret system. The experiments are merely a continuation of those described by Dr. Nichols in a lecture delivered before the Institution of Electrical Engineers in February of 1923. Following the first successful reception of speech by wireless telephone from America in January of that year, the Postmaster-General appointed a committee, under the chairmanship of Admiral of the Fleet Sir H. B. Jackson, to investigate the possibility of establishing a commercial telephone service between England and America. Under the supervision of that committee, special receiving stations were established in this country, and a series of experiments and observations on the reception of speech from America have since been in progress. Similar experiments on the transmission of speech to America have not been, and cannot be, undertaken until the Post Office transmitting station at Rugby has been completed.

The Voyage of the R 33.

ON Thursday morning, the 16th inst., ten minutes before ten o'clock, the airship R 33 was torn from her mooring mast at Pulham and driven out to sea. The movable arm at the top of the masthead was sheared, and the nose of the vessel crashed on the railings round the top of the mast, with the result that No. 1 gas bag was punctured, and the bow of the ship torn and shattered. Within a few minutes of the accident, the crew were at their posts, the engines were running, and the ship was kept head to wind at a slow speed. It was necessary to lace the front bag to No. 2 frame, in order to form a new bulkhead, and this hazardous operation was carried out quickly and without mishap. Before a wind of between 40 to 50 miles per hour, the airship was driven stern first across the North Sea to the coast of Holland. Throughout the day and the night good wireless communication was maintained with Pulham, Croydon and Rotterdam, and with the H.M.S. destroyer Godetia, which followed the ship across the North Sea. When over Holland the Dutch authorities offered every assistance and landing facilities if required, but the R 33 was able in the early hours of Friday morning to make for Lowestoft, was sighted at Pulham airship station before two o'clock in the afternoon, and was landed and safely housed some two hours later. What might easily have been a disastrous accident was, by the able handling of the ship by Flight-Lieutenant Booth, his wireless operator, and his crew, turned into a fine performance. The repairs, which will be immediately undertaken, will occupy some six weeks. It may be recalled that the American airship Shenandoah broke away from her mooring mast in January last year, but her unofficial flight was only for eight hours, compared with the thirty hours of the R 33.

Trade Unions and the Shipbuilding Inquiry.

IN an address given at Sunderland towards the end of last week, Mr. J. T. Brownlie, the President of the Amalgamated Engineering Union, dealt with the invitation extended by the Shipbuilding Employers' Federation to trades unions in that industry to form a joint committee to investigate the costs of production, both within and without the industry's sphere of control. In urging the acceptance of the invitation, Mr. Brownlie referred to the strong appeal on the part of organised labour, and particularly on the part of the trades unions, for a greater share of control in industry. He did not imagine, he said, that the employers would straightway meet such a demand, but by becoming members of the proposed joint committee, a preliminary step in the direction of obtaining a greater control would be taken. It was very desirable, he thought, that trades unions should look very closely into their own affairs, for it was of doubtful value to the trade union movement, or to any other section of the community, to have something like thirty unions in existence. So far as the shipbuilding industry was concerned, it involved a considerable amount of friction, overlapping, and unnecessary negotiations. The conditions that obtained thirty to forty years ago, admirable and acceptable as they may have been at that period, were not suitable for present-day requirements.

A New Italian Liner.

ON Thursday (yesterday) William Beardmore and Co., Ltd., launched at their Naval Construction Works, Dalmuir, the liner Conte Biancamano, which has been built to the order of the Lloyd Sabaudo, Genoa, for service between Italy and North and South America. Both in dimensions and accommodation, the vessel represents a very marked advance on the two previous ships, the Conte Rosso and Conte Verdi, which in 1921 were built at Dalmuir for the same owners. The new liner has an overall length of 655ft., a breadth of 76ft., and a depth of 48ft., with a gross tonnage of about 23,000 tons. Accommodation for special first-class and first, second and third-class passengers is provided, and the total ship's complement will be about 2250 persons. The propelling machinery, which is generally similar to that which was installed in the two earlier ships, but somewhat larger, was entirely designed and constructed at Dalmuir. It comprises two 12,000 shaft horse-power sets of compound double-reduction geared steam turbines of the Parsons impulse and reaction type, designed to develop a total of about 21,000 shaft horse-power at 95 revolutions of the propeller, corresponding to a service speed of 20 knots. Steam will be raised in seven double-ended and two single-ended boilers, fitted with smoke tube superheaters and tangential dryers, and arranged for burning oil fuel on the Wallsend-Howden forced draught system.

Machinery of U.S.S. Saratoga.

IN connection with the recent launch of the Saratoga, the new American aircraft carrier, details of her propelling and auxiliary machinery have now been released by the Washington Navy Department. It is pointed out that the power developed by her propelling plant, viz., 180,000 shaft horse-power, will exceed the combined rated output of the six electrically driven American battleships now in service. In the words of the Chief of the Bureau of Engineering, it represents "the greatest volume of horse-power per shaft that has ever been projected in any marine installation, irrespective of the type of motive power." The plant, which was manufactured by the General Electric Company, consists of four 35,200-kilowatt turbine generator sets, supplying current to eight electric motors. The turbine generators will be operated by steam from sixteen oil-fired boilers. The motors, to be connected in pairs to each of the four propeller shafts, total 440,000 lb. in weight, each having an individual capacity of 22,500 horse-power and a diameter of 15ft. The shafts will turn at 317 revolutions per minute at full speed. In addition to the propelling plant, the Saratoga is to be provided with six 750-kilowatt, direct-current auxiliary turbine generator sets, which will furnish current for all subsidiary purposes. Another distinctive feature of the vessel will be a wireless equipment, which is expected to exceed in range that of any plant hitherto installed in a ship. The 'tween deck space is described as "a perfect nest of hangars, workshops, store rooms and magazines." Stowage space is being provided for seventy-two aircraft, and a complete set of spare parts for every machine.

The British Steam Railway Locomotive from 1825 to 1924.

By E. L. AHRONS, M.I. Mech. E.

No. XVII.*

PERIOD 1855–1859 (*continued*).

Tank Engines, with Leading Bogies.—In 1855 five 4–4–0 side tank passenger engines—Fig. 119—were built by Messrs. Stephenson for the North London Railway. They constituted an entirely new departure, and as regards wheel arrangement were the forerunners of the later standard engines of this railway. The cylinders (inside) were 15in. by 22in ; diameter of coupled wheels, 5ft. 3in., and of bogie wheels, 3ft.; the total wheel base was 16ft. 3in.; the coupled wheels being spaced with centres 6ft. 6in. apart. The pivot was fixed and of the Gooch ball-and-socket joint type, and the bogie, like Gooch's, had a single inverted spring on each side. As the coupled wheel springs were connected by compensating levers, the engine was suspended on three points. The bogie frames and axle-boxes were outside the wheels. Its wheel base was only 4ft. 6in., and the pivot was placed behind the smoke-box. In this respect it resembled Gooch's design, and also in that the driving wheels were without flanges, the tires being 6in. wide, those of the remaining wheels having a width of 5in. The clasp brake on the trailing wheels only was characteristic of Stephenson's tank engines at this period.

In 1857 Messrs. Hawthorn built six 4–4–0 saddle tank engines for the East Kent (later, part of the London, Chatham and Dover) Railway to T. R. Crampton's design. They were noteworthy in being the forerunners of the well-known French type of coupled engine, in which the outside cylinders were placed immediately in front of the first coupled axle under the middle of the boiler and the connecting-rods drove the trailing axle. The steam pipes were taken through the sides of the smoke-box. The cylinders were provided with steam jackets with internal ribs. As in many French and continental designs, the whole of the Gooch valve gear was outside. The bogie wheel base was 4ft. in length; the cylinders were 15in. by 20in.; and the coupled wheels 5ft. 6in. diameter. In general appearance they were very similar to some tender engines which will be described later.

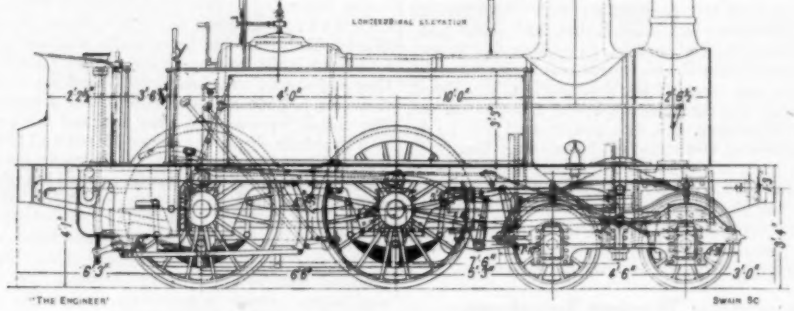


FIG. 119—R. STEPHENSON AND CO.'S TANK ENGINE, 1855

An experimental engine designed by J. C. Craven for the L.B. and S.C.R., and built in 1859 at Brighton works, is shown in Fig. 120. Its chief features were the steeply inclined outside cylinders, 15in. by 22in., spaced 6ft. 4½in. centre to centre, and the rigid centre pin bogie placed with its leading axle under the cylinders. The coupled wheels were 5ft. and the bogie wheels were 3ft. diameter. The bogie had bar frames, and a compensating lever with single spring on each side. The bogie wheels were 4ft. apart ; centre of bogie to driving axle, 8ft. 0½in.; coupled wheel centres, 6ft. 9in.; total wheel base, 16ft. 9½in. All bearings were inside. This engine worked satifactorily, but a somewhat similar engine of 1861, in which the outside cylinders were horizontal and placed between the bogie wheels, with the wheel base extended to 19ft. 2½in., of which the bogie base was 5ft. 11in., was a complete failure, and would not remain on the rails. This was probably due to the peculiar design, in which the body of the engine was not carried on the bogie centre, but was supported on angle iron brackets fixed on the four corners of the engine and bogie framing.[1]

Other Four-wheels Coupled Tank Engines.—Only one or two types need be mentioned. Fig. 121 shows the well-known 2–4–0 side tank engines of the L. and N.W.R., originally built by F. Trevithick, at Crewe. They were mostly conversions of the Allan type of 2–4–0 tender goods engines, though the first examples of the class built in 1856 were constructed with side tanks. The coupled wheels had a diameter of 5ft., the cylinders were mostly 15in. by 20in., and the pressure varied from 110 lb. to 120 lb. There were more than one hundred of these engines, which were ultimately employed on local traffic on all parts of the line.

Another 2–4–0 side tank passenger engine—Fig. 122—by Beyer, Peacock and Co., 1858, for the Belfast and County Down Railway, had outside horizontal cylinders, 15in. by 22in., and 5ft. 6in. coupled wheels It was provided with Beattie's patented feed-water heating apparatus. The brake blocks were actuated by a form of toggle joint. This was a favourite form of brake gear of Charles Beyer, and appeared on several of Sharp's earlier tank engines, for the design of which he was responsible.

Passenger Tank Engines, with Six-wheels Coupled.—In 1856 the first six-coupled tank engines—Fig. 123*—designed expressly for passenger trains were built at the Miles Platting (Manchester) works of the Lancashire and Yorkshire Railway for service on the severe gradients of the Oldham branches. These engines, designed by W. Jenkins, antedated Stroudley's celebrated Brighton "Terriers" by sixteen years, and were of considerably larger dimensions than the latter. The cylinders were 15in. by 24in.; the coupled wheels, 5ft. diameter ; and the weight in working order was 29 tons 3 cwt. The saddle tanks extended from the front of the smoke-box to the front of the fire-box casing. The four first engines of 1856–7 were slightly different in details from the engine illustrated, which was built in 1860. The former had coupling rods of circular section, which were standard on the L. and Y.R. until the latter date.

0–6–0 *Goods Engines.*—During this period the standard British 0–6–0 goods engine attained the final characteristics which it has continued to hold until the present day. The modern engines are larger, and many of the latest have been provided with superheaters, but in their main features, such as the solid inside slab frames, slightly inclined inside cylinders, &c., the design is similar to that of the old engines.

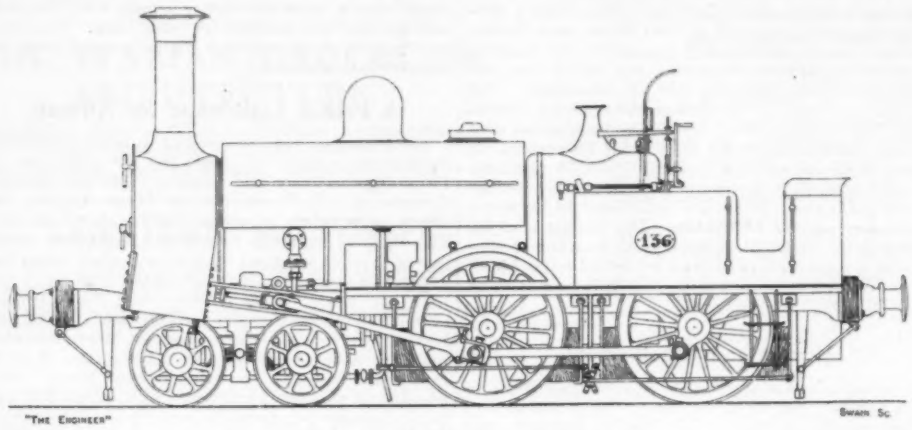


FIG. 120—L.B. AND S.C. TANK ENGINE, 1859

Although not the earliest, Ramsbottom's 0–6–0 D.X. standard goods engines may claim first attention. The first experimental engine of the type was built, not at Crewe, but at Longsight, Manchester, in 1858, and was laid down when Ramsbottom was superintendent there of the North-Eastern division of the L. and N.W.R. Subsequently, from November, 1858, until 1872, no less than 840 to 850 of these engines were built at Crewe for the L. and N.W.R., in addition to 86 for the Lancashire and Yorkshire Railway, which were also constructed at Crewe during 1871–4. All of these engines, about 930 in number, were identical in almost all respects, and the class presented the first example of standardisation and mass production of locomotives on such a large scale. In this connection, it should be added that similar standard work on a smaller scale had long been the practice with a few of the private locomotive-building firms, notably Sharp Brothers[2] and E. B. Wilson and Co.[3] It is extremely probable that Ramsbottom acquired his first ideas on such standardisation from Messrs. Sharp Brothers, where he had been employed for about three years before becoming locomotive superintendent of the Manchester and Birmingham Railway at Longsight in 1842, and subsequently for the next fifteen years had ordered many of Sharp's standard locomotives and spare parts for use on the railway.

Fig. 124 shows one of these goods engines as originally built.[4] The cylinders were 17in. by 24in., inclined at 1 in 8 ; coupled wheels, 5ft. 2in. diameter ; wheel base, 7ft. 3in. + 8ft. 3in. The boiler was telescopic with the largest ring at the fire-box end, and contained 192 1¾in. tubes ; total heating surface, 1102 square feet ; grate area, 15 square feet ; pressure, 120 lb.; weight : leading, 9 tons 14 cwt.; driving, 10 tons ; trailing, 7 tons 6 cwt.; total, 27 tons in working order.

FIG. 121—L. AND N.W. SIDE-TANK ENGINE, 1856

The engines were extremely light. The tractive force per pound M.E.P. was 111.9, and, taking 85 per cent. of boiler pressure as the mean effective pressure when starting, the total tractive force was

* No. XVI. appeared April 17th.

[1] The description of these engines is taken from "The Locomotives of the L.B. and S.C.R.," published by the Locomotive Publishing Company, Ltd. The drawing is by Mr. G. F. Burtt.

* From a photograph by Mr. R. E. Bleasdale.

[2] The Engineer, April 24th, 1923, pp. 194–196.
[3] The Engineer, October 15th, 1920, pp. 369–372.
[4] For sectional elevation and plan see Colburn's "Locomotive Engineering," Plate XV.

11,410 lb., which gives a factor of adhesion of 5.3.

The inside frames were stayed longitudinally between the horns. The details presented some important novelties, though whether these appeared in the earliest of the class in 1858 or were incorporated about 1860–1 the writer is unable to say. The most important of them was the screw reversing gear, which Ramsbottom brought out about 1858–9, and as far as the writer knows, he was the first locomotive engineer to use it. The regulator in the dome was of the double-beat type. The engines of 1861 and later had brick arches, which, instead of being inclined upwards from front (tube plate end) to back, were inclined downwards in the opposite direction to deflect the air which entered the fire-box through two square openings in front below the arch. No fire-door deflector appears to have been used with this arrangement. Volute springs placed above the axle-box and below the footplate were used for the trailing axle. The motion was of the form with two slide bars and short forked connecting-rod, a design which, derived from Allan's outside cylinder engines, became standard on most L. and N.W.R. engines until 1904.

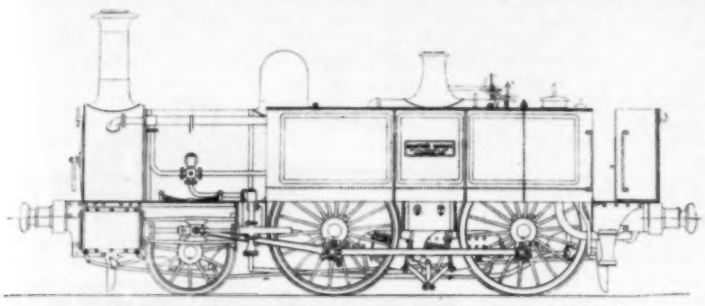


FIG. 122—BEYER PEACOCK AND CO.'S TANK ENGINE, 1858

One of the best examples of the British standard goods engine, illustrated in Fig. 125, was designed by Charles Beyer, of Beyer, Peacock and Co., in 1857, and therefore antedated Ramsbottom's engine described above. Beyer's influence on locomotive design was very marked, more especially after the founding of Beyer, Peacock and Co. in 1854. Though the engine illustrated was built for the Egyptian railways, it represents a classic design, of which a number of engines with various minor modifications were built for home railways. The principal features were the plain simplicity of the engine and the solid deep plate frames, in which Beyer rarely employed tie bars between the horns. The hornblocks were welded solid with the frames, a form of construction to be found in some of Stephenson's early four-wheeled engines of 1832. The fire-box casing was raised, but in similar engines built from 1861 onwards it was flush with the barrel. Many of Beyer-Peacock's early engines had the dome over the casing, though the firm had no definite standard, and during the same period built designs with domes on the centre of the barrel, and also with domeless boilers. Probably the position of the dome was decided in accordance with the ideas of the railway locomotive engineers.

The taper of the chimney, which was of larger diameter at the bottom than at the top, was also another feature of Beyer-Peacock's practice for many years. In the engine illustrated the chimney was 15in. diameter above the mouthpiece and 13⅜in. at the top. Stephenson's and Sharp's chimneys were also tapered in a similar manner, as also were those of Messrs. Hawthorn, though to a smaller extent, and at a later period we also find the same principle in many of W. Stroudley's Brighton engines. Most of the other builders used parallel chimneys, and the only designer, who between 1850 and 1860 employed chimneys wider at the top than at the choke, was Robert Sinclair on the Caledonian and afterwards on the Eastern Counties Railway. The form of chimney decreasing in diameter towards the top was probably due to the old theory that the action of the jet of steam was that of a series of plugs which filled the chimney, and that as part of the steam condensed on its way up it was therefore necessary to reduce the chimney area to allow for the decrease of volume. Moreover, the fuel used before 1860 was generally coke, and the volume of smoke-box gases was less than in coal-fired locomotives. Beyer, Peacock and Co. and others had the benefit of the knowledge derived from Peacock's blast pipe experiments[5] on the M.S. and L. Railway, as a result of which their blast pipes were placed at a level immediately above the top row of tubes, and not close to the base of the chimney as had been the practice till that time. It should, however, be noted that in some of Stephenson's engines of the "Planet" class, built in 1833, the blast nozzle was placed near the bottom of the smoke-box and the chimney prolonged downwards in the form of a "petticoat."

The goods engine described above had 16in. by 24in. cylinders, 5ft. wheels and wheel base 15ft. 6in., equally divided. The dimensions did not differ greatly from those of Ramsbottom's engine, but the 191 tubes were 11ft. 7¼in. long by 2in. external diameter, as against 192 tubes 10ft. 9in. long by 1⅞in. diameter in the L. and N.W.R. engine. In spite of this the fire-boxes were of practically equal length.

The double-framed goods engine was nevertheless generally preferred, and an interesting example is illustrated in Fig. 126. It was built by Beyer, Peacock and Co., in 1858, for the Midland Railway, the locomotive department of which desired to test Beattie's patented fire-box and feed-water heater, and therefore left the design of the two engines in the hands of the builders.

Both inside and outside frames extended from front to back buffer beams, and were the first examples on the Midland Railway of this improved construction. The solid deep outside frame without tie rods between the horns was characteristic of a design used by the firm for similar engines for more than forty years. A minor, nevertheless important, detail was the snapped rivet heads both in the frames and in other parts of the engine. Whenever they could be avoided Beyer, Peacock and Co. never used countersunk heads. The snapped heads were of larger diameter than those generally used, and instead of being well rounded were considerably flattened on the top. This may seem an unimportant detail, but the writer has frequently heard it stated by various district locomotive superintendents on different railways that they had rarely if ever known one of Beyer Peacock's rivets loose in any part of an engine. The writer can confirm this statement from one of his own experiences when he had to remove some of them which had been in the engine twenty-five years, and all had finally to be drilled out.

The cylinders were 16in. by 24in.; coupled wheels, 5ft. diameter; wheel base, 8ft. + 8ft. 3in. The boiler contained Beattie's patented fire-box and combustion chamber, to be described later. There were 396 tubes, $1^{3}/_{16}$in. outside diameter, in the front part of the barrel, the length between the tube plates of combustion chamber and smoke-box being only 5ft. 6¾in.; heating surface of tubes, 722 square feet; of fire-box, 114 square feet; of combustion chamber, 74 square feet; total, 910 square feet; grate area, 17 square feet; weight in working order, 33 tons 3 cwt. The pressure is not definitely known, but was probably 130 lb., as in other Midland engines of 1858.

One other 0–6–0 type may be briefly mentioned. Two engines were built for the Glasgow and South-Western Railway and were the first 0–6–0 locomotives designed by P. Stirling and of a type with outside cylinders very rare in British practice. They were built by R. and W. Hawthorn at the end of 1855. The cylinders were 16in. by 21in.; coupled wheels, 4ft. 6in.; wheel base, 12ft. 4in., equally divided; total heating surface, 770¾ square feet, of which the small fire-box provided only 48¾ square feet; grate area, 9½ square feet. The tender was on four wheels, 3ft. diameter. The type was never repeated, and Mr. Stirling designed no more six-coupled engines until eleven years afterwards, by which time he had abandoned outside cylinder coupled engines and domed boilers.

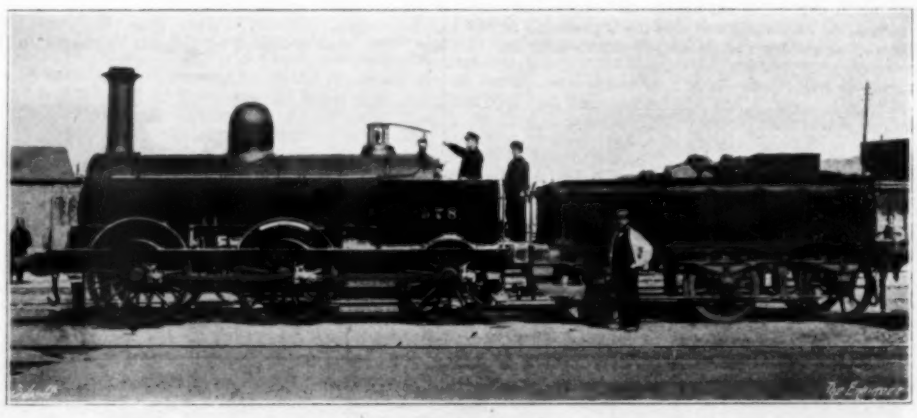


FIG. 124—L. AND N.W. GOODS ENGINE, 1858 - 1872

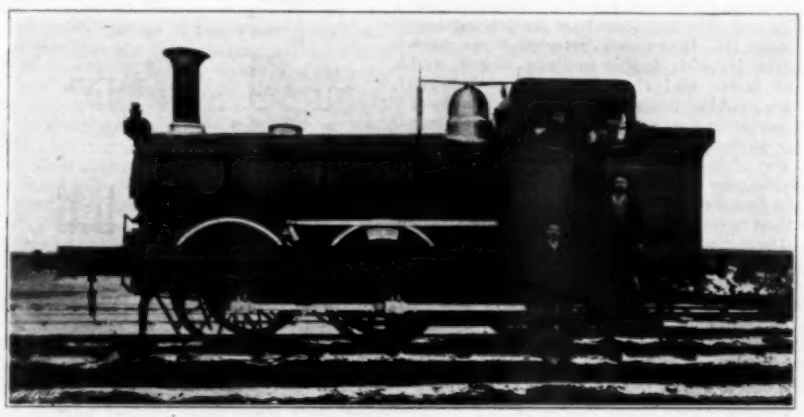


FIG. 123—L. AND Y. TANK ENGINE, 1860

Neilson's Single-cylinder Locomotive. — In 1857 Messrs. Neilson and Co., Glasgow, constructed a number of four-wheeled saddle tank shunting locomotives[6] for colliery and ironworks railways in Scotland. They are shown in the diagram, Fig. 127, and were of unique design. A single cylinder, 10in. by 16in., was placed on the centre line of the engine below the furnace at the footplate end. The piston-rod, which came out at the back of the cylinder, was pinned to the centre of a transverse crosshead, to the outer ends of which the connecting-rods were attached. The latter drove the trailing wheels, 3ft. 2in. diameter, by means of outside crank pins. The trailing wheels were coupled to the leading wheels. The left-hand coupling-rod worked directly on the driving crank pin extension in the usual manner, but on the right-hand side a thin crank was interposed between the connecting and coupling-rods in such a way that the right-hand and left-hand coupling rods were at 90 deg. This arrangement assisted the engine over dead centres, and prevented the two connecting-rods from moving the wheels in opposite directions at the beginning of a stroke. The fire-box consisted of a ᗢ-shaped furnace, 3ft. 8in. long, with flat top stayed with transverse girders, and between the furnace and smoke-box tube-plates were 74 tubes, 5ft. long. Steam was taken from a dome at the back of the boiler to a valve at the side of the footplate, which served as a regulator, and thence passed downwards to a steam chest on the left-hand side of the cylinder. The reversing gear consisted of two excentrics, one at each end of the leading axle, with short rods terminating in gab forks, to which a transverse shaft was attached by lifting links. The valve spindle came out at the back of the cylinder, where it was attached to a short "crosshead." To the outer ends of this crosshead two long valve rods, which passed one on each side of the cylinder to the cross shaft, were connected.

DETAILS.

In 1855 *Beattie's Feed-water Heating Apparatus* came into use on the London and South-Western Railway. It went through various modifications,

[5] See D. K. Clark "Railway Machinery," pp. 133–134.

[6] W. M. Neilson's patent, April, 1856, No. 988.

but since it was fully described in The Engineer, March 16th, 1923, page 280, it is unnecessary to give a further account of it. It is interesting to note that the system of taking about 15 per cent. of the exhaust

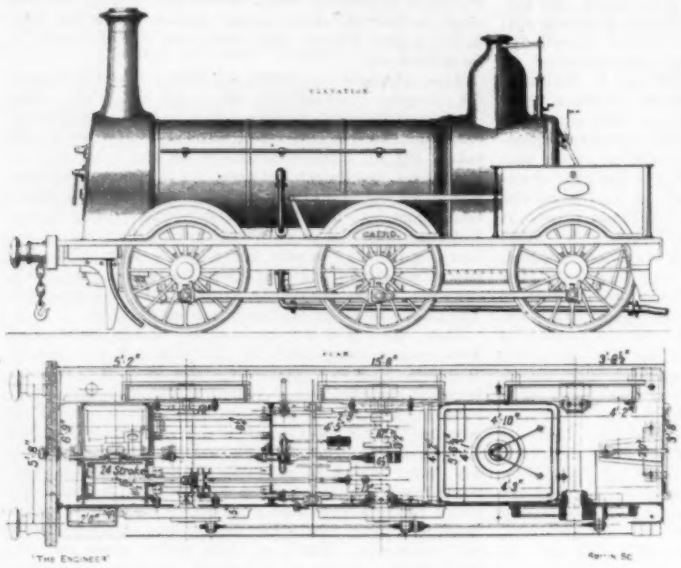


FIG. 125—BEYER PEACOCK AND CO.'S GOODS ENGINE, 1857

steam from the blast pipe and condensing it in the tender or in other special apparatus employed, does not appear to have affected the back pressure in the cylinders, either by increasing or decreasing it. A

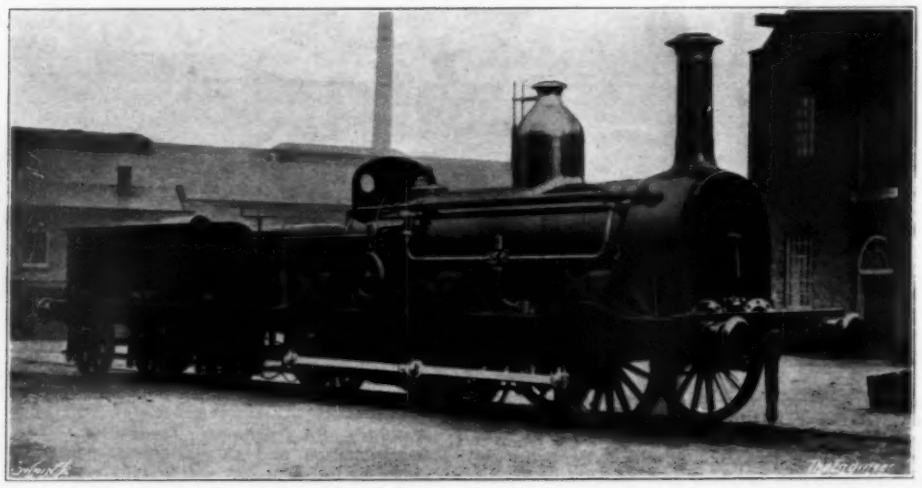


FIG. 126—MIDLAND GOODS ENGINE, 1858

series of trials by Bauschinger with similar German condensing feed-water heating apparatus showed a similar result. The friction in the long pipes appears to have offset any theoretical advantage due to con-

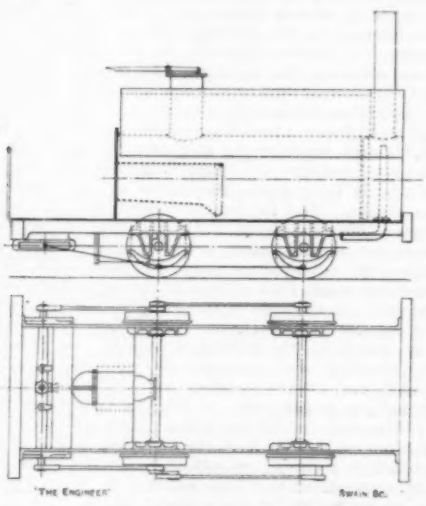


FIG. 127—NEILSON'S SINGLE CYLINDER ENGINE, 1857

densing. Beattie's system, which undoubtedly showed considerable thermal economy, was tried on several British railways, but, except on the L. and S.W.R., was abandoned after a short time, partly on account of the complication and expense of upkeep, but probably chiefly owing to the introduction of injectors in 1859–60.

Cast Iron Fire-bars may have been used at a very early period, but their more extended application dates from about 1856–8 in connection with coal fuel.

Stays.—In 1855 David Joy on the Oxford, Worcester and Wolverhampton Railway, owing to fire-box stay troubles due to bad water, drilled the ends of the stays with "detector" holes, ¼in. diameter, to give warning of the impending breakage of the stay.

Coupling Rods.—The form of coupling rod used by J. Beattie on the L. and S.W.R. from 1859 and for many years later is shown in Fig. 129. The usual vertical cotters were replaced by horizontal wedges with a fine screw adjustment, which enabled the brasses to be taken up without hammering down the cotters too tightly. A peculiar design of coupling-rod end was applied by W. Fairbairn and Sons to some tank engines built in 1855, and is shown in Fig. 128. Elastic india-rubber cushions were placed between the ends of the brasses and the iron body of the rod end to allow for careless adjustment of the length by fitters and drivers. The arrangement does not appear to have had much, if any, further application.

Axle-boxes, Wheels, Tires, &c.—The axle-box—Fig. 130—was designed by Messrs. Fairbairn for end carrying axles to provide a lateral controlling force tending to restore the box to its central position by means of round india-rubber washers when leaving a curve. The axle-box A did not bear directly against the hornecheeks B. Interposed between them were the side pieces D, with double inclined planes, and between the latter and the channel-shaped horncheeks B, three rubber washers C were placed on each side. The restoring force was exerted by the effort of the latter to resist compression. This appears to have been one of the earliest forms of axle-box with controlled side play and a small angular movement, but like the coupling-rod does not appear to have had more than a few experimental applications.

At about the same time, Bissell trucks were patented in this country in May, 1857, though their earliest application to a British-built engine—for abroad—was not made until about three years afterwards.

A form of compensating lever for double-framed engines was applied by Kitson and Co., in order to connect the springs of one carrying and two driving bearings on each side. The arrangement is shown in Fig. 131. The lever was inclined, one end being connected to the spring pin of the carrying bearing, and the other to a long spring pin common to the inside and outside springs of the driving axle.

Tires were of wrought iron welded in some cases with steeled-faces. According to W. P. Marshall,[7] solid steel weldless tires were manufactured by Krupp in 1851, but when they were first used in this country is uncertain. Beattie's iron tires of 1859 were made with a lip on the outside—Fig. 132—to prevent the tire from coming off. A stud was inserted between each pair of spokes.

Valve Gears and Motion.—In 1856 Alex. Allan's straight link motion was first applied to two 0–4–2 goods engines on the Scottish Central Railway, of which the inventor was then locomotive superintendent. The gear, which was extensively used, is so well known as to require no further mention. It has not been applied to any new engines in this country for more than twenty-five years, but a considerable number of L. and N.W.R. engines, built from 1874 to 1897 were fitted with it, and many are still in service.

In most of the engines with Stephenson's link motion the valve rods were jointed and suspended by swing links from a small bracket attached to the bottom of the boiler, and in later and improved designs this bracket was fastened to the top of the

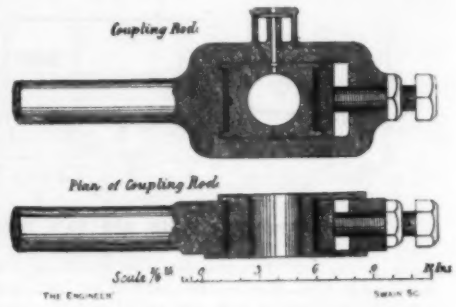
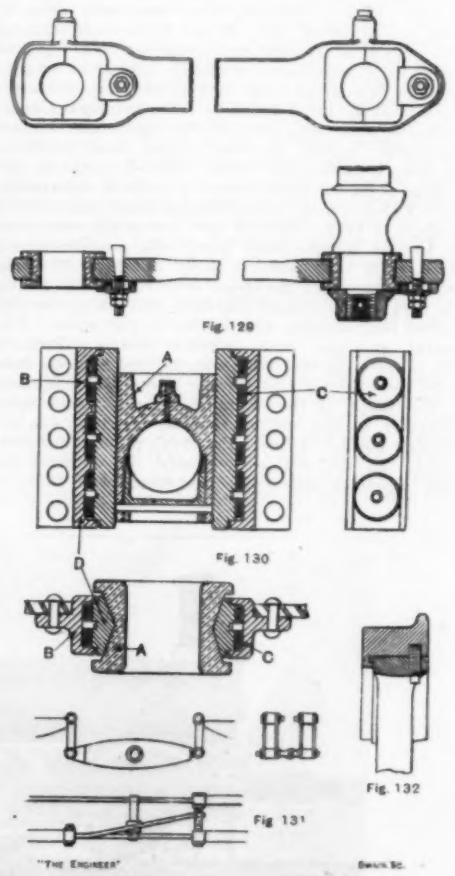


FIG. 128—FAIRBAIRN'S COUPLING ROD

motion plate. This was a good arrangement, in that it enabled the designer to obtain long excentric rods, since the expansion link could be placed well in front of the motion plate. This motion, in the case of the 16in. and 17in. engines of the 1855–1880 period, always gave good results. Some engineers objected to the wear of the pins at the valve-rod joints, and Ramsbottom was one of the first to modify this design. In his D.X. goods engines of 1858 the valve-rods worked in a guide attached to the slide bars. The arrangement was different from that usually seen in that the valve-rods were of rectangular section, and both worked together in a single rectangular guide.



FIGS. 129 TO 132

Since their inner sides rubbed against each other, rubbing plates of brass were let into these sides. This motion was adopted at a later date on the Great Western Railway. Whether it had any advantages over the usual designs is very doubtful. It certainly had the disadvantage of shortening the excentric rods. Matthew Kirtley in the Midland engines of 1857 and later used a gun-metal valve-rod guide, bolted on the top slide bars, instead of to the motion plate, and in this way obtained the advantage of long excentric rods. Each valve-rod worked in a separate circular hole in the guide in the usual manner. This motion can be seen on nearly all the Midland 2–4–0 engines, on which it was used until 1881. It was illustrated in a drawing of a Midland goods engine—The Engineer, Supplement, June 7th, 1872.

[7] "Proc.," Inst. C.E., 1898.

The United States and Rigid Airships.

THE United States, from which sixteen years ago the brothers Wright brought the first successful aeroplane, was almost the last of the Great Powers to acquire and experiment with rigid airships. At the present time the United States Navy is in possession of two fully commissioned airships of this type, and experience is being rapidly obtained in their navigation and general management. None of the other nations is in a similar position, although last May the British Government placed orders for the construction of two rigid airships, one for military and the other for commercial purposes, and it has recently been stated that the latter will be ready for trials in about twelve months.

By an arrangement between the United States and British Governments entered into shortly after the Armistice, the rigid airship R 38, then under construction at the Royal Airship Works at Bedford, was to be transferred on completion to the United States. She was designated ZR 2, and officers and men of the United States Navy were sent over to watch her construction, and undergo a course of training on a British airship, preparatory to manning the new vessel for her flight across the Atlantic. The destruction of R 38 over the Humber in August, 1921, whilst undergoing her trials, postponed for a time the possession of a rigid airship by which the United States Navy could obtain the desired experience. The construction of an airship, the ZR 1, had been started at Lakehurst, New Jersey, prior to the completion of R 38, and profiting by the experience with the latter, and the results of the investigations carried out by the British authorities into the causes of the disaster, modifications were embodied in the new vessel which it was anticipated would eliminate all sources of weakness or undue strain. This airship—now the Shenandoah—was completed about eighteen months ago, and although subjected to a series of more than ordinary severe tests, passed through them most successfully.

By Article 202 of the Versailles Treaty, all sheds and appliances of every kind at Friedrichshafen for the construction of airships exceeding 30,000 cubic metres—about one million cubic feet—in volume had to be destroyed, but, by an agreement with the Allies, the German authorities were permitted to construct a rigid airship for the United States Government. This vessel, of about 2½ million cubic feet volume, reached Lakehurst on October 15th last, having been navigated from her place of construction by a German crew. Originally the ZR 3, she has since been named the Los Angeles, and by the terms of the agreement already referred to, she is to be used solely for commercial purposes. The future has not yet been determined by the American authorities, but for the present she is being utilised for training purposes, and for experimental distant flights, with the object of determining her utility for commercial work, and primarily for the carriage of mails. The Shenandoah has a volume of slightly over two million cubic feet, so that both ships are considerably smaller than the two ordered by the British Government, which are to have a capacity of five million cubic feet.

The two American airships have been in practically continuous commission since their completion, and several notable flights have been made by both. The Los Angeles in her voyage from Germany to America travelled 5070 miles in 81¼ hours, the highest speed attained being 80 miles an hour. Of the 32 tons of petrol with which she started, 7½ tons remained when she arrived at the housing shed at Lakehurst. For this voyage she was inflated with hydrogen, but on her arrival this gas was replaced with helium. On February 21st she carried out a flight from Lakehurst to Bermuda, a distance of about 750 miles, in 12 hours, hovered over the islands for some time, and returned to her shed without mishap.

The longest flight of the Shenandoah was in October when she crossed the American continent and returned, the whole distance flown being 8100 miles, the airship being under way 235 hours, and absent from her hangar for 18¼ days. Stops were made at several convenient stations during the flight, the vessel being secured in the open to temporary mooring masts. During this flight, and especially when crossing the mountains on the West Coast, the Shenandoah was subjected to very heavy winds and other unfavourable weather conditions, all of which were successfully surmounted without mishap. Another notable flight was one of 1300 miles carried out in conjunction with some manœuvres of the American Fleet. The Shenandoah was absent from her base for 72 hours, cruising for 40 hours, and during the flight reached 450 miles from the American coast over the Atlantic, where she discovered four "enemy" ships, one of which she claimed to have "destroyed" by bombing.

The most exciting and spectacular flight of the Shenandoah was made on January 16th, 1924, when, whilst secured to the mooring mast at Lakehurst, she was struck by a 70-mile an hour gale, which was accompanied by exceedingly heavy rain. The vessel's structure was so severely strained that the nose was torn off by the mooring rope and she was freed from the mast. In addition to the damage forward, one vertical fin was injured and the rudder post distorted. Despite these injuries and the severe atmospheric conditions, the officers and crew, the numbers of which were short of the full complement, by superb navigation, successfully operated their vessel, rode out the gale, and on its subsidence returned to the hangar at Lakehurst, where the airship was safely housed. This experience was rendered more severe by the darkness, the airship breaking adrift at seven o'clock in the evening and not returning until half-past two the next morning. Admiral Moffet, the chief of the United States Naval Air Service, has given it as his opinion that a similar accident to an airship inflated with hydrogen must have resulted in her destruction and the loss of the crew.* Only a month before the French rigid airship Dixmude, whilst on the return flight made from her base at Toulon to the French Protectorates in North Africa, had been caught in a heavy gale and disappeared into the Mediterranean Sea. The Court of Inquiry which investigated the matter reported that she had been struck by lightning, but the evidence on this point was not very definite.

The earlier flights of the Shenandoah had been so satisfactory, that towards the end of 1923 it was decided that she should make a flight to the North Pole. The necessary preparations were taken in hand, the most important of them being the provision of a floating base, which it was intended should proceed to the most northerly position practicable, await the airship, and render any necessary assistance. The Fleet tanker Patoka was selected for this service, and was fitted with a mast about 130ft. high, to which the airship could be secured. Arrangements were also made to carry three seaplanes, about two million cubic feet of helium, and the necessary fuel and other stores. The flight was not carried out, President Coolidge, possibly influenced by the disaster to the Dixmude, and also by the breaking adrift of the Shenandoah from the mooring mast at Lakehurst, vetoing the proposal. The Patoka has, however, continued in service as an airship base, the Shenandoah having been moored to the mast in Chesapeake Bay to test the mooring arrangements, and the Los Angeles recently in Baltimore Harbour. She was also stationed off the coast of Greenland in case of necessity, when the Los Angeles made the voyage from Germany last October. The Patoka is the first of a new type of Fleet auxiliary, of which, it seems probable, several more will be fitted out in the next few years.

The experience which has been obtained by the American Navy with the two airships on the flights which have been mentioned, and on many others of shorter duration, has evidently impressed the United States naval authorities and also the general public with the utility of this type of aircraft for both commercial and military purposes. Already suggestions have been made for the construction of larger vessels, and it has been stated that the Navy Department has prepared the specifications and plans for one of six million cubic feet capacity, or nearly three times the displacement of the Shenandoah. The length is given as 785ft. and the diameter 122ft., compared with 695ft. and 130ft. for the new British airships. The gross lift when fully inflated would be 170 tons, and it is estimated that a commercial load of 22 tons could be carried. The maximum speed is given as 70 miles an hour, the cruising speed 50 miles, and the radius of action 4600 miles. It is extremely probable, however, that before the construction of this larger vessel is approved by Congress and the necessary appropriations voted, a more extended experience with the two completed airships will be demanded. At the present time only one large airship shed, in which the Shenandoah and Los Angeles are housed, is available, and the construction and completion of a second shed would be necessary before the work on a larger airship could be started.

A very full programme has been prepared by the Naval Department for the Los Angeles during the next few months. Between February 16th and 26th she was scheduled to visit Bermuda, and the flight was actually made on the 21st. Between March 3rd and 17th she was to visit Porto Rico (1500 miles) and between April 8th and May 10th the Panama Canal zone (2200 miles). The Patoka had proceeded to Bermuda to await the airship, but it was found unnecessary to secure her to the mooring mast. She is to be at Porto Rico and Panama during the flights to these two places. Between May 20th and June 20th the Los Angeles will visit Honolulu, or as an alternative will fly to Europe. A more modest programme was prepared for the Shenandoah, which at the end of March visited Southern waters. This programme of flights may be taken as an indication that the naval authorities feel assured of the ability of the airships to carry out relatively long voyages, and that the mooring and other arrangements on the Patoka are sufficient for every eventuality.

The interest which is being taken in the two airships by the American people is reflected in the public Press, and more particularly in those magazines and journals which specialise in aeronautics. Two years ago the pages of the latter were almost wholly filled with articles and other matter relating to heavier-than-air craft, but at the present time a very substantial proportion of their space is allotted to airships. Readers are supplied with full details of the flights and movements of the Shenandoah and Los Angeles, and are being instructed in the differences in types, the principles and details of construction, and other matters appertaining to airships.

It is evident from the articles which are appearing in such publications that the success which up to the present has attended the operations of the two airships is mainly attributed to the use of helium for filling the gasbags. This conclusion appears, on the whole, to be an eminently reasonable one. A recent article calls attention to the immense advantage which the United States hold over other nations in possessing helium in such a form that it can be obtained at a reasonable cost, and in very large quantities. The article calls on the authorities to conserve the supply of helium so as to secure a paramount position, so far as airships are concerned, for commercial and military purposes. It estimates that at present 85 per cent. of the natural gas, from which helium is obtained by processes of compression and liquefaction, is not being treated for the abstraction of this valuable element, and states that by this neglect six million cubic feet of helium are being wasted every month. The article hints at the introduction of legislation in the very near future with the object of conserving all available supplies. Two years ago the National Advisory Committee for Aeronautics, in its annual report, strongly recommended Congress to pass measures for the acquisition and sealing by the Government of the largest and richest helium fields.

An article in a second publication contains some interesting details of the costs of preparing helium and hydrogen. According to the writer, hydrogen can be obtained in America at from two to three dollars per thousand cubic feet. Before the war the cost of the same volume of helium was 1700 dollars. Experiment and research suggested the best method of obtaining quantities such as are required for airships, and a plant was erected at Fort Worth, Texas, where natural gases containing the maximum percentage of helium are available. Just before the Armistice the cost had been reduced to 146 dollars. Experience with the first plant led to improvements and economies and the present cost is 40 dollars, or from fourteen to twenty times that of hydrogen. Helium, however, has an advantage over hydrogen in that it can be withdrawn from the gasbags of an airship, "purged" of impurities, and used again. The writer states that if this possibility is taken into account the cost is about ten times that of hydrogen.

The relatively high cost of helium has necessitated the study of every economy in its use in airships. The United States engineers have for some time been experimenting with an apparatus by which the water formed by the combustion of the petrol in the engine cylinders is condensed and retained on the airship, instead of escaping through the exhaust pipes. By this means the weight of the airship is maintained constant, with the result that it is unnecessary to let helium escape from the gasbags. Without water recovery apparatus the weight decreases, and to restore equality between weight and buoyancy gas must be liberated or "valved." The apparatus fitted in the Shenandoah is stated to be very satisfactory, and on relatively long flights practically no helium has been lost. The Los Angeles was fitted with similar apparatus after her arrival in the States.

A third article dealing with helium refers to its advantages and disadvantages as compared with hydrogen for use in airships. It points out that in addition to the higher cost, its greater density results in a loss of about 8 per cent. of the gross lift, which in a vessel of five million cubic feet volume would amount to 12 tons. Such a loss of paying load in a commercial airship must be of the utmost importance from the economic point of view. The article observes that in hydrogen-filled airships the primary danger is in the petrol gas. For these reasons it inclines to the opinion that in the future commercial airships will be inflated with hydrogen and driven by Diesel engines. The great difficulties in reducing the weight of such engines to render them suitable for the purpose are emphasised, and it is stated that experiments in this direction are proceeding in America. For military purposes, however, the helium-filled airship is held to be far superior to one inflated with hydrogen.

At present the United States Navy alone is experimenting with rigid airships, but a company has been formed in America with the object of building such vessels and operating them for commercial purposes. This company has purchased, or taken over, the Zeppelin rights for North America, and has secured the services of some of the most prominent designers and engineers of the German Zeppelin Company. An airship of the semi-rigid type with a volume of 720,000 cubic feet is at present under construction by the company, and on completion will be taken over by the United States Army authorities. This airship is stated to be the first of the type built in America, and in its design Italian engineers with considerable experience in such ships were called in to advise. The company is presumably awaiting the results of the flights of the Los Angeles before proceeding to build a rigid airship.

From the foregoing remarks it may be concluded that the rigid airship, which in this country has experienced so many fluctuations in development, has in the United States reached a most interesting stage.

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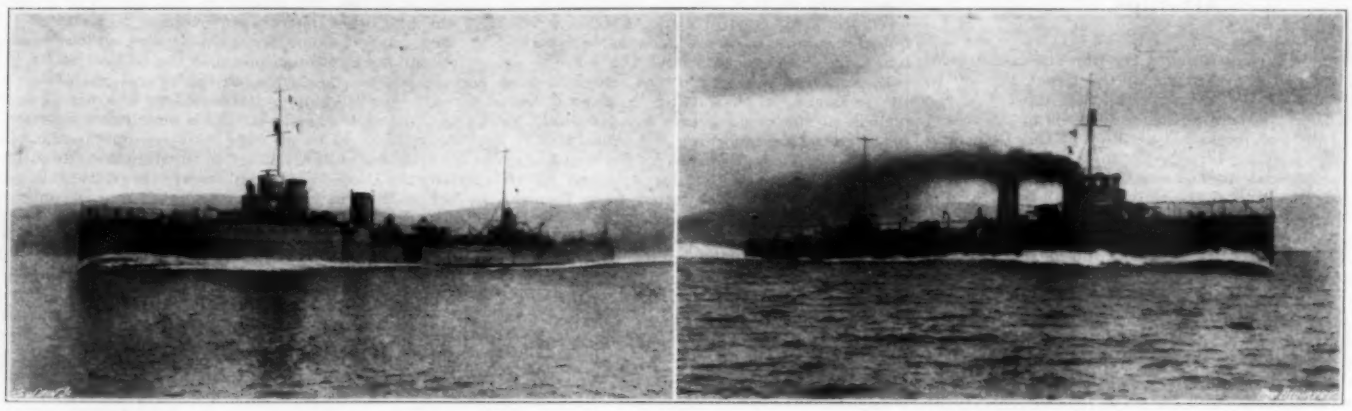
* The R 33 had not then had a similar experience and demonstrated the incorrectness of this theory.—ED. THE E.

NEW SCOUTS FOR THE ITALIAN NAVY



THE LEONE THE TIGRE

Its progress during the next few months will be followed with the closest attention by the American public and also by large numbers of the British.

Institution of Electrical Engineers.

ROLL OF HONOUR, 1914–1919.

We have been favoured with a copy of the Roll of Honour of the Institution of Electrical Engineers—an imposing volume which has been prepared by a specially appointed Committee to perpetuate the memory of the one hundred and sixty-two members of the Institution who lost their lives in the Great War of 1914–1919. It is a wonderful and most praiseworthy production, the compilation of which must have entailed a vast amount of labour. It runs to some 330 pages, and an average of two pages, or nearly 1800 words, is devoted to each of the one hundred and sixty-two fallen members. In each case, after a short reference to the early life and business training of the member, an astonishingly detailed history of his military services is given. It requires but little imagination to realise the pains which must have been taken to piece together these consecutive memoirs from what must have been fragmentary information acquired with great toil from numerous sources. Only those who have assisted in, or been closely in touch with, similar work can form an adequate estimate of the patience and perseverance which must have been exercised in the collection and co-relation of the necessary data. Of nearly every notice it can be said that it forms a miniature history of the war in the sphere or spheres in which the member it deals with played his part. In a large number of cases there is added, at the end of each record, a note written to some relative from a commanding officer or from some comrade in arms, all of them setting out the sterling qualities or the prowess in arms of the dead man.

In all but three instances photographs are given, and the majority of the reproductions are excellent. Even those which have had to be enlarged from palpably poor originals are, for the most part, commendably good. All, however, would have looked better had they been printed on a rather more highly glazed paper.

The volume is prefaced by a carefully prepared discussion of the "Origin and Causes of the Great War, 1914–1919," prepared by Lieut.-Colonel W. A. J. O'Meara, a member of the Memorial Committee and the editor of the book, while at the end there is a Colophon, from the pen of the late Mr. C. H. Wordingham, the chairman of the Committee, in which acknowledgment is made of the help received from persons and bodies who rendered assistance to the Committee in the carrying out of its task. Finally, there is a series of coloured maps of various theatres of the war.

The book is well printed in large type, by Unwin Brothers, Ltd., the Institution's printers, and is a credit in every way to them, to the Committee and to everyone else concerned in its production.

The permanent change-over from the old aerial of 2 LO on the roof of Marconi House to the new one in Oxford-street took place on April 6th. The results of tests show that quite 90 per cent. of listeners in London are getting stronger signals from the new aerial than they did from the old one, while the extended range of the station has brought additional people into effective crystal range of the station. Some people are getting slightly weaker signals from the Oxford-street station, and in such cases the British Broadcasting Station advises that listeners should improve their own aerials. Further tests are to be made, while, in addition to the copper "petticoat" arrangement round the masts, a "feeder" aerial is to be tried. Both aerials will oscillate simultaneously and thus increase the radiation.

New Italian Scouts.

Since H.M.S. Swift was laid down nearly twenty years ago the flotilla leader has become a popular type with most of the leading navies of the world. It is, of course, simply an enlarged destroyer, and its functions are sufficiently defined by the name. The Swift herself was a vessel of 2200 tons, but in later flotilla leaders for the British Navy a smaller displacement was accepted for reasons of economy. It remained for Germany to build, during the war, a group of 2300-ton boats with very high speed and an armament of four 5.9in. guns. One of these vessels was subsequently taken over by France, who appears to have modelled her new leaders of the "Jaguar" class on somewhat similar lines. They are of 2359 tons and are designed for a speed of 35.5 knots. The main armament consists of five 5.1in. guns. Italy also has been paying marked attention to the development of the leader type, of which she already has several fine representatives. As part of her war programme she laid down five units of the "Leone" class, but two of these craft, the Leopardo and Lince, were afterwards cancelled.

The Leone, Tigre and Pantera have all been completed during the past few months, and we are

THE PANTERA

indebted to the builders, Gio. Ansaldo and Co., of Sestri Ponente, for the accompanying views of these interesting vessels. Their principal dimensions are:—Length, 359.6ft. between perpendiculars; breadth, 33.8ft.; draught, 11.5ft.; normal displacement, 2165 tons. Each vessel is engined with four sets of Parsons turbines with gearing, operating twin screws, and drawing steam from four Yarrow oil-burning boilers. The normal fuel supply is 200 tons, but the full stowage capacity is 400 tons. The forecastle deck is carried well aft to provide an adequate freeboard. The stem is straight, and the flare at the bows is less pronounced than in contemporary British boats.

In accordance with Italian practice, the armament is extremely powerful in proportion to the displacement. Eight 4.7in. guns are mounted in pairs on the centre line—the first pair on the forecastle, the second between the funnels, the third amidships, and the fourth at the stern. While the two guns revolve on a common turntable, each can be elevated independently of the other, and to avoid interference in loading and working the pieces each is housed in a separate shield. This arrangement should do much to overcome the difficulties which are met with in the case of the ordinary light twin mounting, and which tend to restrict both the speed and accuracy of fire. The guns are 45 calibres in length. In addition there are two 3in. anti-aircraft guns. The Leone carries two triple 18in. torpedo tubes, while the Tigere and Pantera are understood to have two double 21in. tubes instead. Each vessel is fitted to carry sixty mines.

According to the official Italian designation of the class they are small scouts (Esploratori leggeri), though in this country they would be termed flotilla leaders. It is reported that the Pantera and Tigre will shortly visit England on a practice cruise.

Obituary.

SIR D. GOLDSMID-STERN-SALOMONS.

By the death of Sir David Lionel Goldsmid-Stern-Salomons, which occurred on Sunday last, an ingenious and enthusiastic worker has been removed from the electrical industry. He was born at Brighton in 1851, and was the only son of Mr. Philip Salomons. Much of his earlier education was derived from private sources, and both then and during the short period he subsequently spent at University College, London, he passed much of his spare time making friends with foreign craftsmen who were at that time centred round Soho. In due course he passed on to Caius College, Cambridge, were he took Honours in Natural Science, and later he settled down to scientific work. He devoted much time to the design of electric carriages, and wrote books and pamphlets on the technique of electric lighting, photography and many other subjects, and at one time he made a small alternator which generated current at a very high periodicity. For many years he was treasurer and vice-president and a member of the Council of the Institution of Electrical Engineers, having proposed its formation from the Society of Telegraph Engineers. Proud of the fact that electrical power had been installed in his house since the year 1874, he never tired of inventing fresh means of using it, and his home soon became a fascinating museum of applied science, one of his treasures being an extremely small electric motor. During the war all the heavy machinery of his workshops was given to the Government and used for munition work. Sir David took a great interest in radio communication, and he claimed for Hughes that he was the first to show that telegraphy was possible without wires. He was a Fellow of the Royal Astronomical Society, the Royal Geographical and the Physical societies.

Recent Oil Engine Developments.*

In passing under review the many types of British oil engines which are to-day available for power purposes, the author limits the scope of his paper to engines exhibited at last year's Wembley Exhibition, which engines, he considers, fairly record the latest developments and indicate the possible trend of future design and construction. Tables I. and II. have been prepared in order to show the magnitude and capacity of British factories, and the different builders exhibited seventeen marine and fifteen stationary designs at Wembley. Where arrangement is referred to in the column headings of the table, it is implied that the same design of engine as the original or licensed design is built by another firm, or firms, under an arrangement. In indicating the range of horse-power up to which engines are built, the number of cylinders employed is shown in brackets following the horse-power figure.

Low-pressure engines include all those using no higher compression pressures than 150 lb. per square inch. Medium pressure engines embrace designs employing compression pressures between 150 lb. and 300 lb. per square inch; and high-pressure engines are taken to include all types which utilise a higher compression pressure than 300 lb. per square inch. In dealing with the construction of the engine, the four-stroke and the two-stroke types are differentiated, as are also the two methods of air and mechanical injection of the fuel. The author comments on the marked interest among manufacturers

* Summary of a paper read by Mr. J. L. Chalmer before the Diesel Engine Users' Association, April 17th, 1925.

with respect to utilising mechanical injection in favour of air injection, and notes a tendency towards the adoption of the two-stroke design for larger powers. For these powers he regards the four-stroke single-acting type as having unquestionably seen its most rapid rate of growth, which rate in future will gradually and consistently diminish.

After a paragraph referring to aero engines in which the Beardmore six-cylinder heavy oil engine, designed to develop 600 brake horse-power at a speed of 1300 revolutions per minute with a weight of about 3 lb. per horse-power, is mentioned, heavy oil engines for automobiles are dealt with, and it is remarked that athough much has been done by continental engineers, no serious attempt has been made on the part of British manufacturers to solve the problem. The same remark, it is added, may be said to apply to the large oil engine locomotive, which is still in the experimental stage.

In connection with the large type marine oil engine, it is noted that a large number of the designs are of continental origin. It has been more or less general practice for British marine engine builders to select what appeared to them the most promising foreign type of oil engine, and generally evolve a construction incorporating their own general marine experience. This policy has been found to work very satisfactorily, and, in fact, has helped the British marine oil engine industry to keep abreast with modern developments, despite the conservative attitude displayed in the beginning. From Table I. it will be apparent that all the principal engineering firms are to-day associated with one or more types of oil engines.

The following designs of marine oil engine are then described:—Parsons, Tosi, Werkspoor and Vickers, of the four-stroke single-acting type; Doxford, Fullagar, Neptune, Nobel and Sulzer, of the two-stroke single-acting type; Werkspoor, of the four-stroke double-acting type; and North British, of the two-stroke double-acting type. It is unnecessary to refer further to these engines, all of which have been described and illustrated in our pages. They are illustrated in Mr. Chaloner's paper by a series of excellently reproduced drawings.

Passing to the hot-bulb marine types, reference is made to the Beardmore, British Kromhout, Gardner, Mumford, White and Vickers-Petter designs.

The popularity of the oil engine for stationary power generation is indicated by the large number of engineering firms—see Table II.—concentrating on the manufacture of various sizes up to 1500 brake horse-power, although this power is by no means the limit of the modern large-sized unit. Continental types of 4000 brake horse-power in six cylinders are actually in commission.

Among hot-bulb engines of the industrial class, the outstanding points of the Allen, Crossley, Mirrlees, Petters, and Robey designs are given: whilst the Blackstone, Crossley, Gardner, Hick Hargreaves, National, Ruston, Tangyes, and Weir types are recorded in the class of cold-starting engines. Finally, the stationary Diesel engines built by Allen's, Beardmore, Belliss and Morcom, Cole, Marchent and Morley, the English Electric Company, and Mirrlees, Bickerton and Day are described. The author sums up his very complete review as follows:—

General Conclusions.—At present the most marked progress is being made in the marine world, and with the introduction of 20,000 indicated horse-power twin installations for passenger and mail steamers, the oil engine covers to-day about 95 per cent. of the total power requirements of the mercantile marine. In view of the fact that the marine type is a later development than the stationary plant, it is surprising that 3000 indicated horse-power marine units are standard products as against 1000 indicated horse-power in the case of stationary sets. One may say that marine conditions being more arduous, this progress is a very positive testimonial to the reliability of the oil engine in general. There is little doubt that the experience gained in the marine section will give an impetus to the construction of larger sets for central power station work, and already a start has been made in that direction.

The simplification of design, the greater use of steel castings, the standardisation for mass production, and other items of constructional policy are being taken advantage of to make the oil engine in every way competitive to other forms of power generators. The large array of types presented nowadays to the prospective customer do not facilitate decision as to what make is to be installed, and for that reason competition is particularly keen. The decision on the part of the British manufacturers of cold-starting engines to fix some uniform price per brake horse-power is very interesting in this connection.

So far, no material development of the double-acting engine for stationary purposes can be recorded, but greater interest in the two-stroke cycle type is being displayed for the larger sizes, which are now required for power production. Little doubt exists that the finality of constructive development leans in the direction of two-stroke cycle double-acting construction combined with the mechanical injection system. Whether the employment of a pre-combustion chamber will become standard practice is an open question, in view of the very divided opinion which prevails at present on this constructional point. As regards the systems of ignition, it is fairly conclusive that 380 lb. per square inch is the safe practical limit for ignition purely by the heat of compression and without the aid of external sources of heat.

Electric ignition devices and the use of steam are methods which have found considerable support in effecting a positive ignition under lower compression pressure conditions, and one may say that the cooling effect of the compressed air for injecting the fuel calls for an additional 50 lb. to the compression pressure. The supercharging problem is also receiving attention, and its application for meeting temporary peak loads or for forming a part of the standard equipment is a matter for early practical development. The increase in the volumetric efficiency introduces more favourable cyclical temperatures within the combustion chamber, and hence higher mean pressures can be utilised without proportionate increase in the heat stresses of the cylinder walls.

The refusal on the part of all concerned to consider seriously the utilisation of the exhaust gases is a matter of no small surprise. One of the principal reasons is, no doubt, the limited use for hot water and low-pressure steam, which can be found in any power installation. For marine work, such opportunities are greater, and hence exhaust gas boiler installations are more frequent, although they do not in any way form part of a standardised equipment. As regards the use of heavy fuels, attention has recently been drawn to the deleterious effect of the mechanical impurities in the fuel, and "centrifuging" is becoming a standard practice, although the employment of low-grade fuels for oil engines is by no means as extended as might be warranted by the relative conditions of supplies and price.

TABLE I.—*Marine Types.*

Type.	Design.				Construction.				Horse-power.
	British.		Foreign.		Stroke.		Injection.		
	Original.	Arrangement.	Licence.	Arrangement.	Four.	Two.	Air.	Mech.	Range up to—
Medium pressure	1	—	—	—	1	—	1	—	320 (4)
	14	1	1	—	—	16	—	16	600 (6)
High pressure	2	—	6	2	10	—	10	—	8000 (8)
	3	5	7	—	—	15	15	—	3500 (6)
	1	—	—	—	1	—	—	1	2700 (8)
	3	2	—	—	—	5	—	5	3000 (4)
	24	8	14	2	12	36	26	22	
	48				48		48		

TABLE II.—*Stationary Types.*

Type.	Design.				Construction.				Horse-power.
	British.		Foreign.		Stroke.		Injection.		
	Original.	Arrangement.	Licence.	Arrangement.	Four.	Two.	Air.	Mech.	Range up to—
Low pressure	13	—	—	—	13	—	—	13	160 (4)
	2	—	—	—	—	2	—	2	35 (2)
Medium pressure	6	—	—	—	6	—	—	6	320 (4)
	24	2	1	—	—	27	—	27	500 (6)
High pressure	6	—	1	—	7	—	7	—	1000 (8)
	—	1	1	—	—	2	2	—	1500 (6)
	13	1	1	—	15	—	—	15	900 (6)
	1	—	1	—	—	2	—	2	600 (6)
	65	4	5	—	41	33	9	65	
	74				74		74		

The Lytham Derailment.

IT will be remembered that on the evening of November 3rd last, as an express from Liverpool to Blackpool (Central) was passing Warton signal-box near Lytham, it was derailed, with such serious results that, as regards fatalities, it was the worst accident since that at Jarrow in December, 1915. Fourteen passengers lost their lives and the driver was killed. Another passenger died some weeks later. The disaster was caused through the leading left-hand wheel of the bogie of the engine—No. 1105 of the 4–4–0 type—losing its tire. Subsequent examination of the tire showed the existence of a large defect in the centre of the tread, which had an area of something over 1 square inch, owing to a blow-hole cavity in the metal. This was sufficient in itself, when the $^9/_{16}$in. wear of the tire was taken into account, to cause failure. When the failure actually took place is not known, but a space of 3in. had developed at the point of fracture, and the five stud screws were sheared off. The tire left the wheel at a point about 352 yards from a girder underbridge. The companion, right-hand, wheel, left the rails immediately afterwards. Apparently the enginemen were unaware of the failure, as speed was maintained. Just before the underbridge is reached the down line, on which the train was travelling, is joined by a connection from a siding on the up side. The derailed right wheel struck this connection, and then the near side girder on the down side of the underbridge was hit, and the derailment resulted.

The accident was inquired into by Colonel Sir John Pringle, whose report, accompanied by a key map, a plan of the scene of the derailment, drawings of the wheel and tire, and a photographic reproduction of the fracture slab, has just been issued as a Stationery Office publication, price 1s. It is related that the tire was one of thirty-four made from castings from a heat of February 27th, 1920. Up to September 2nd, 1924, when the engine was in Horwich works for general repairs, the wheel had run 100,355 miles. The tire was then turned up, thoroughly inspected, went through the usual bumping test without any flaw being detected, and the engine went again into service on October 24th. Since that date it had run 712 miles, making a total mileage for the wheel of 101,067.

Pieces of steel cut from each side of the fracture were subjected to analysis and examination at Horwich, and at the National Physical Laboratory. The results are given in the report, which observes: "The existence of phosphorus to a slightly greater extent than is desirable is indicated in the chemical analyses. Sulphur prints taken show no segregation. Etchings prove that microstructure and heat treatment have been satisfactory. Microscopic examination of the immediate region of the defect showed the existence of minute cavities extending from the main cavity. These indicate that the defect, at one time larger in extent, was folded into the material during manufacture without complete welding, and that the strength of the metal was thereby considerably reduced. The contention of the railway company that the existence of the defect could not have been discovered during manufacture of the tire, and that the existence of a defect of this size was sufficient in itself to account for the failure of the tire, is supported by the conclusion of the National Physical Laboratory."

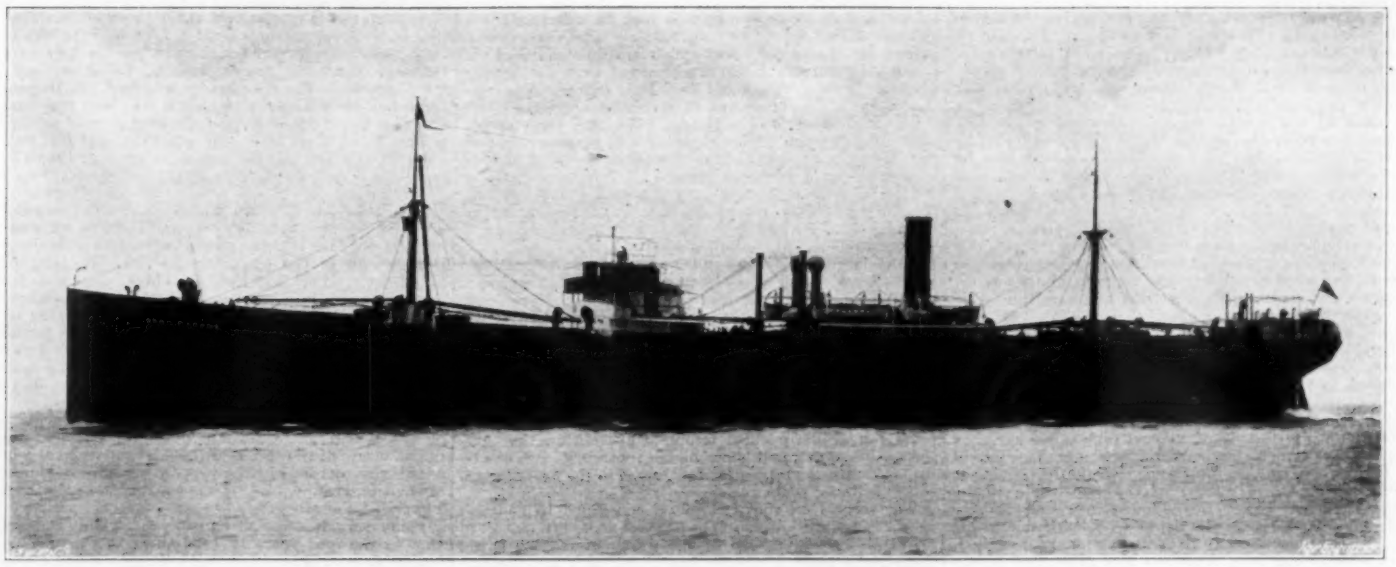
Some very interesting figures are given. It is shown that in the four years 1921–24 there was a total of 267 broken tires on British railways—sixty-two tires of engines, nine of tenders, thirteen of coaches, and 183 of wagons—and that the average incidence of the failures of tires of engines and tenders was about 1 in 27 million engine miles. It is comparatively rare for an engine or tender tire, even when it breaks, to leave the wheel. Out of the twenty-nine cases which occurred in 1923 and 1924, the whole tire remained on the wheel after failure in twenty-two instances. Not since 1893 has there been an accident due to tire failure which occasioned loss of life or injury to any passenger. Sir John Pringle observes that the above figures illustrate, he thinks, the great improvements that have been effected in the manufacture, design and material of wheel tires, the infrequency with which tire failures now occur and the comparative rarity of a case of serious accident arising therefrom. He proceeds, however, to say that there are two directions in which further consideration and research are required. They are:—(*a*) The allowance which should be made for shrinkage of locomotive tires, the desirable manner of measuring such allowance, the most effective method of fastening tires to wheel centres, and the degree of permissible wear. Practice in all these respects varies on different railways, and standardisation in what may be determined to be the best direction is desirable. (*b*) The establishment of a practical means of detecting the existence of flaws in steel used in the manufacture of locomotive tires, axles, &c. It has recently been stated in a lecture by Mr. V. E. Pullin, of the Research Department at Woolwich, that some new X-ray apparatus has been made which has enabled a mass of steel, 4in. in thickness, to be penetrated. If an apparatus of the kind can be designed for use in what may be called every-day workshop examination of tires, &c., defects of the nature which led to this accident could possibly be detected.

THE WATER SUPPLY OF TORQUAY.

A PAPER on the Torquay water supply system was read at a sessional meeting of the Royal Sanitary Institute held at Torquay on Saturday, April 18th, by Mr. S. C. Chapman, the borough water engineer. After sketching the history and development of the existing works, Mr. Chapman said that the growth of Torquay and the surrounding areas made it necessary to provide water at levels which were beyond the reach of existing service reservoirs and at greater altitudes, and it also became apparent that the trunk mains were incapable of keeping pace with the heavy demands of a dry summer season. One of the most interesting features in the Torquay supply was the extraordinary variation in levels. They had houses at a distance of 600 yards from the seashore standing at elevations varying from 200ft. to 500ft. above the sea, and also lands which stood at 500ft. above the sea level on the very outskirts of their areas of supply. It had been decided to construct a service reservoir to hold 1½ million gallons on Great Hill, the key position of the eastern side of the borough, with an elevation of 590ft. A new pipe line, begun in 1914, and interrupted by the war, was now nearing completion, only about 2000 yards remaining to be laid. The cost of the work had been estimated in 1913 at £50,000, but by the time it was completed it would have cost £81,000. The Great Hill Reservoir was on the highest point in the neighbourhood, and from it every part of the borough could be supplied if necessary. The walls of the reservoir would be of mass concrete, faced with engineering brick. The floors, which would be 9in. thick, were to be of concrete, and over them would be a coating of asphalt put on in two thicknesses, which would be brought up like a skirting around the edges of the walls and keyed into the brickwork. The reservoir would be roofed with concrete reinforced with expanded metal, supported by steel joists resting on brick piers. It would measure 140ft. square and the depth of water would be 12ft. The excavated material would be utilised for an embankment all the way round the reservoir. It was intended to measure all the water, both as it went into the reservoir and came out. The estimated cost of its construction was £15,765.

THE SINGLE-SCREW MOTOR SHIP RABY CASTLE

CALEDON SHIPBUILDING AND ENGINEERING CO., LTD., BUILDERS, NORTH-EASTERN MARINE ENGINEERING CO., LTD., ENGINEERS



The Motor Ship Raby Castle.

The single-screw motor cargo vessel Raby Castle was built by the Caledon Shipbuilding and Engineering Company, Ltd., of Dundee, and was engined by the North-Eastern Marine Engineering Company, Ltd., at Wallsend-on-Tyne. She belongs to the Lancashire Shipping Company, Ltd.—James Chambers and Co.—Liverpool, and is specially designed for the service of that firm between New York and the Far East. We recently had the pleasure of attending the official trials of this ship, which is noteworthy as being among one of the largest-powered single-screw motor ships yet constructed, while her North-Eastern-Werkspoor engines embody several new features in design. Some of the principal dimensions of the ship and her main propelling machinery are given in the following table :—

Hull Particulars.

Length overall	412ft. 9in.
Breadth moulded	52ft. 3in.
Depth moulded to shelter deck	37ft.
Load draught	25ft. 6in.
Deadweight carrying capacity	8000 tons
Gross tonnage	4900 tons
Service speed	11 knots

Main Propelling Machinery.

Type : Single-screw, North-Eastern-Werkspoor Single acting motors	
Number of cylinders	8
Diameter of cylinders	730 mm. (28¾in.)
Stroke	1300 mm. (4ft. $3^{9}/_{16}$in.)
Normal speed	92 revs. per min.
Normal brake horse-power	2200
Designed indicated horse-power	3000

The ship was built to Lloyd's special survey, and during construction both the hull and machinery were supervised by Esplen and Sons, Ltd., of Liverpool. Above we give a view of the Raby Castle in ballast trim on the trial run. The vessel is constructed on the Isherwood system, and is of the shelter deck type, with three complete decks which extend the whole length of the ship. There are five holds separated by five water-tight and two oil-tight bulkheads, three forward and two aft of the machinery space amidships. In the double bottom seven main tanks are provided, to carry either fuel oil or water ballast. There is a special fresh water tank, while the fore and after peaks are arranged as water ballast tanks. In the hold immediately forward of the engine-room, an oil-tight bulkhead extends right up to the main deck level, and the two deep tanks thus formed—see Fig. 1—are capable of holding 1000 tons of fuel oil or water ballast. The same drawing shows the large fuel oil tank at top deck level, and the emergency fuel oil tanks in the engine-room.

In addition to being a cargo-carrying ship, the Raby Castle has accommodation for a limited number of passengers. A large saloon house on the shelter deck between the hatchways of Nos. 2 and 3 cargo holds, provides accommodation for eight passengers and four officers, whilst on the bridge deck above there are rooms for a further four passengers and the captain. Above this is the navigating bridge with the chart-room and wheel house. A wireless installation is fitted. Further accommodation for officers and engineers is placed in the side houses abreast of the main engine casing, and the top of this structure forms the boat deck, upon which four 25ft. lifeboats are stowed. The quarters for the crew are at the after end of the shelter 'tween decks, and they are entered from a house on the shelter deck above them. The house also contains the steering engine compartment, and the top, which is extended to the sides of the ship, forms a convenient docking bridge.

Brief reference may be made to the very complete and up-to-date cargo-handling appliances. Each of the two telescopic steel masts is furnished with four 5-ton steel cargo derricks. In addition there are—over No. 3 hatchway—two 5-ton derricks mounted on derrick posts, which are placed one on either side of the ship, forward of the engine casing. A single 20-ton derrick is also fitted which may be worked from either mast. Ten electric winches, six of 3 tons and four of 5 tons capacity, serve the derricks, and two heavy winches are placed forward and also aft, in order to facilitate the working of the large derrick. For the emergency steering gear arrangements, a further 5-ton electrically operated warping winch, with extended shaft and warping ends, is fitted. The whole of the winch equipment was supplied by the Sunderland Forge and Engineering Company, Ltd., Sunderland. The windlass, which is also electrically operated, was built by Clarke, Chapman and Co., Ltd., of Gateshead-on-Tyne, and is placed on the shelter deck with its driving motor below. Brown Brothers, Ltd., of Edinburgh, supplied the steering gear, which is of the firm's well-known electric-hydraulic type. It is accommodated in a house on the after part of the shelter deck with the hand steering gear arranged in the deck above. The gear is worked from the bridge by telemotor gear. The ship is lighted by electricity throughout, and electric heaters by Arch. Low and Sons, Ltd., of Partick, Glasgow, are fitted both in the cabins and for bath water heating.

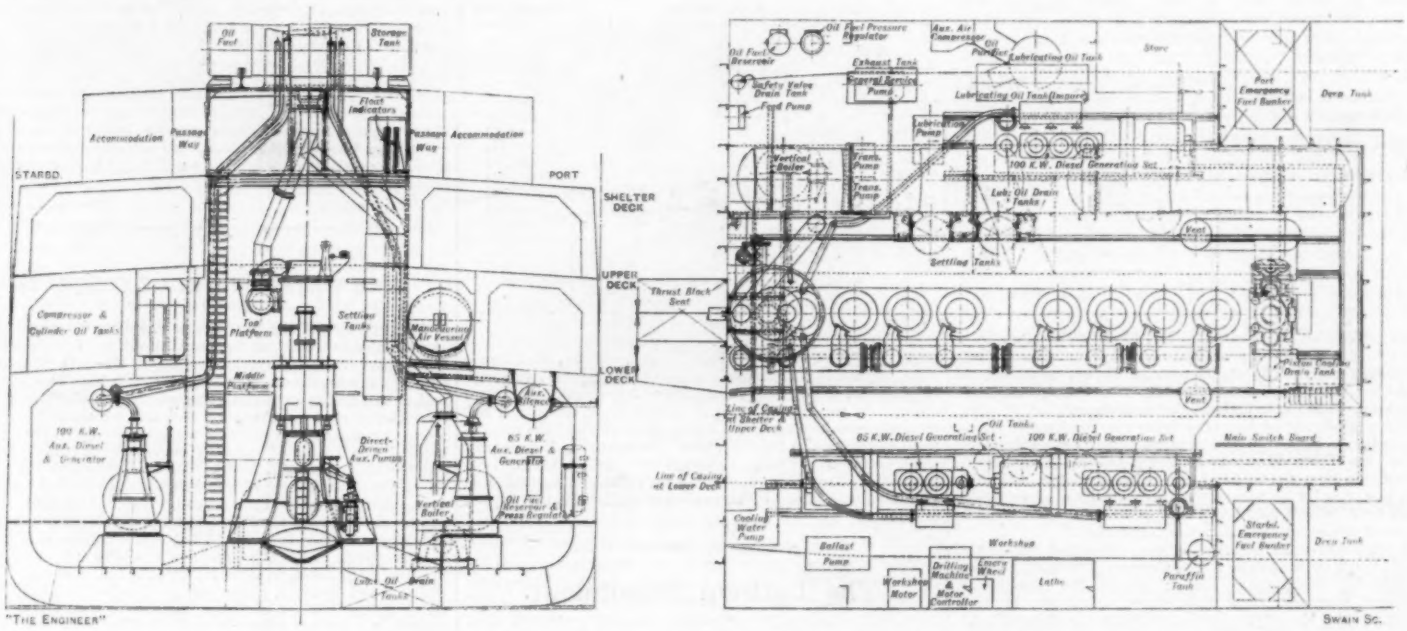


FIG. 1—ELEVATION LOOKING AFT AND PLAN SHOWING THE MACHINERY ARRANGEMENT

Main Propelling Machinery.

The main engines—a photograph of which on the test bed is given in Fig. 2—are noteworthy on account of there being the largest engines of the type

yet built. The principal dimensions and output are given in the previous table. They are also the first British-built engines of the Werkspoor pattern in which cast iron "A" columns placed on the transverse centre line of the main bearings replace the vertical steel columns and diagonal stays which we associate with earlier engines of the Werkspoor type built by the North-Eastern Company. The increased stiffness and the lack of vibration which was a noticeable feature of the bench and sea tests, is illustrated by the fact that the photograph reproduced in Fig. 2 was taken with the engine running at normal speed, and yet there is no evidence of distortion due to movement. Drawing, Fig. 3, is a vertical cross section through one of the cylinders and serves to indicate the main features of the new design. The columns are mounted on a stiff sole plate and long stay bolts pass from the underside of the bed-plate to the top of the cylinder beam, and take the working forces of the cylinder. The eight-throw crank shaft is built up on the "Unity" principle and is constructed in two halves. It is 470 mm., or 18½in., in diameter. The engines are balanced both as regards the main and secondary forces and couples, and the various reciprocating parts have been designed and arranged to reduce torsional oscillation to a minimum when the engines are working at the usual speeds. The steadiness of running was undoubtedly helped by the strong engine seatings to which the sole plate is attached. From the illustrations given, it will be seen that the crank case is entirely closed on the starboard side by light removable steel plates fixed between the columns, and on the port side by the crosshead guide plates, and light doors placed below them. The cylinder beam into which the combined cylinder head and main liners are fixed is supported on short intermediate cast iron columns, and the lower part of the liner is removable, so that when the crank is placed on bottom dead centre, and the liner extension removed the piston is entirely exposed for inspection and can be withdrawn horizontally. Below each cylinder is an oil tray and stuffing-box —see Fig. 3—through which the piston-rod passes. Convenient access to this part of the engine is given from the middle platform. A three-stage main air compressor is placed at the forward end of the engine, and it is driven from an extension of the main crank shaft. At the aft end of the engine a Michell type thrust block is fitted. Alongside the air compressor are three lever-driven pumps, which serve for the piston cooling water, bilge and lubricating duties respectively. We need hardly refer to the standard features of the Werkspoor design, such as the neat excentric valve gear for reversing, the fuel injection system, and bottom platform control, with interlocked telegraph gear. On the engines of the Raby Castle fuel valves with an adjustable lift are fitted. Some reference may here be made to the cooling water, lubricating oil and fuel oil systems. The engines are designed to work with salt water cooling in both the pistons and the cylinder jackets. An interesting feature of the cooling water system is the wise provision of both high and low level sea inlets on either side of the ship, which arrangement should largely obviate difficulty with cooling water when the vessel is lying in a foul berth. The cooling water is supplied to the engine cooling system by a Drysdale "Centrex" type pump, electrically driven, and the hot water from the cylinders is allowed to discharge overboard, whilst that from the pistons falls into inspection troughs, which are arranged at the front of the main columns. The water which flows away from the inspection troughs is discharged overboard by the direct-driven piston cooling water pump.

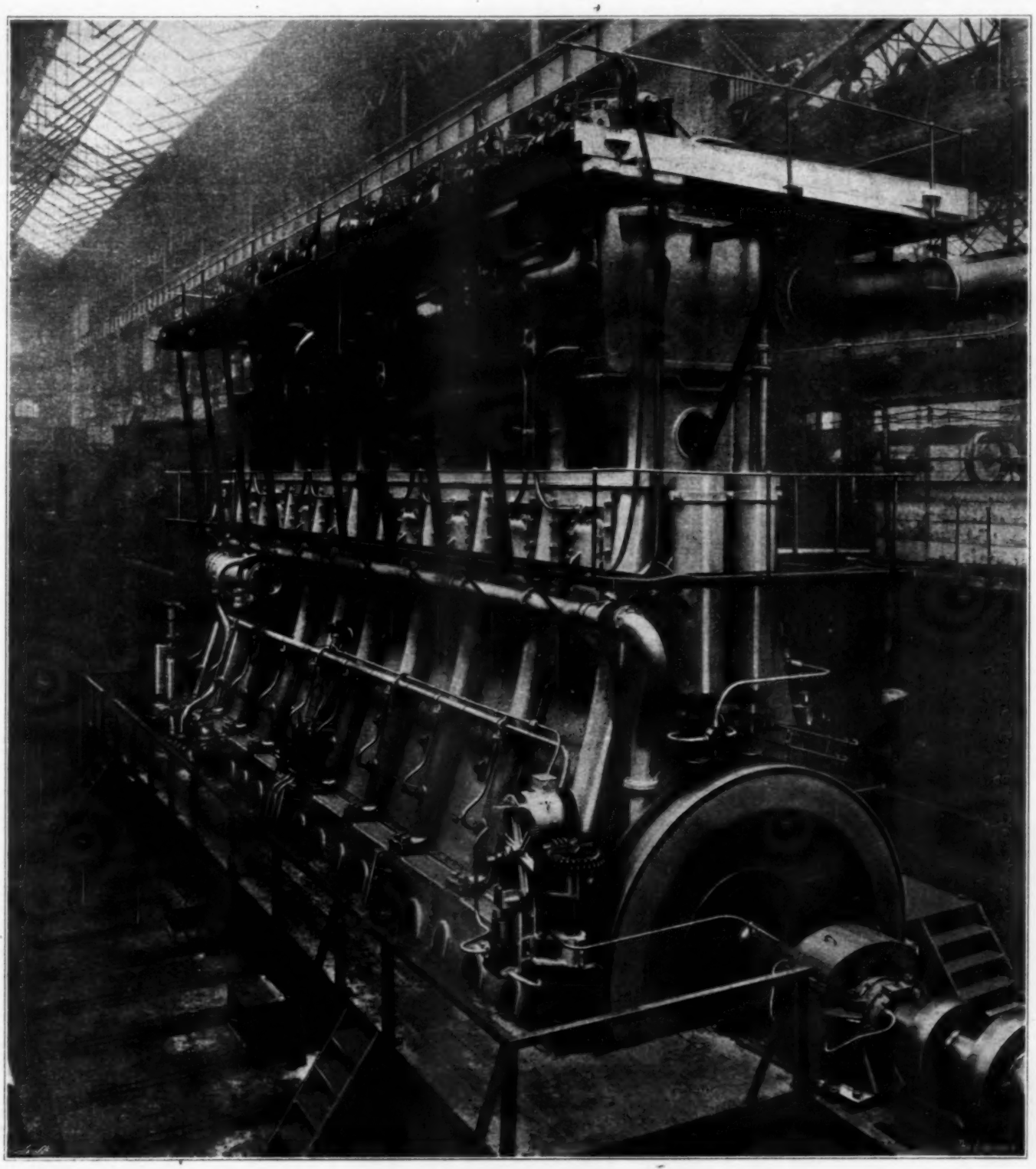


FIG. 2—THE MAIN ENGINES UNDER TEST

The lubricating oil gravitates from the oil sump in the bed-plate to the double-bottom drain tank, shown in Fig. 1. It is delivered to the main bearings again by either the main or auxiliary lubricating oil pump. A lubricating oil cooler is installed in the system along with duplicate filters. When desired, the impure oil can be discharged to an overhead settling tank and purified in a Vickcen centrifugal separator. The oil fuel system is very complete. In addition to the double bottom compartments and

deep tanks, there are port and starboard emergency oil fuel bunkers, and a large supply tank placed transversely at upper deck level. Under tropical conditions, the heat of the sun will warm up the oil in the top tank, which can be then "centrifuged" in purifiers of the De Laval type placed below the tank. By such means or by using steam or electric heating, heavy oils can be satisfactorily dealt with. Two

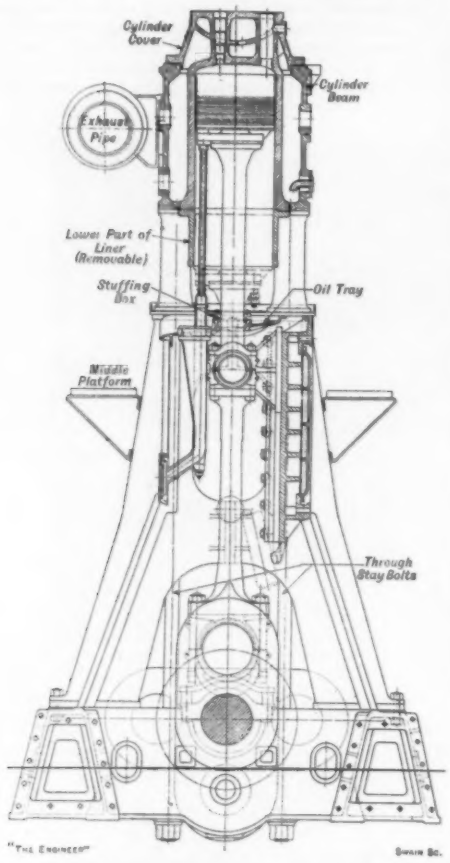


FIG. 3—CROSS SECTION OF MAIN ENGINE

long cylindrical oil fuel settling tanks with float indicator gear are fixed to the port side of the engine-room casing. These tanks are equipped with filters which finally clean the oil as it passes to the two central main fuel pumps. The fuel pump system includes the usual Werkspoor type floating vessel. An emergency fuel pump is also fitted on to the motor of the turning gear shown in Fig. 2.

Auxiliary Engine-room Machinery.

All the auxiliary machinery in the engine-room is electrically driven, with the exception of an emergency steam air compressor, and the oil transfer pump, which are worked by steam supplied from a vertical 100 lb. pressure semi-water-tube oil-fired boiler, by Riley Brothers, of Stockton-on-Tees.

There are three auxiliary Diesel-electric generating sets which were constructed by Werkspoor, Amsterdam, and in consequence of a labour dispute were finished at Wallsend. A view of these auxiliaries, taken in the North-Eastern Company's shops, is given in Fig. 4. The front set is a 65-kilowatt two-cylinder unit, whilst the two behind it are 100-kilowatt three-cylinder sets. As shown in the plan and elevation view reproduced in Fig. 1, one of the large sets is placed on the port side of the engine-room and the other two on the starboard side. In each case the engines are coupled to 220-volt Allen direct-current generators, designed for a normal speed of 250 revolutions per minute. The air compressors on the two larger engines are made so that they can be worked, either as two-stage or three-stage units. When working on three stages, each of these compressors will supply an excess of compressed air over the requirements of its own engine, which air can be utilised for the main engines and for supplying the necessary compressed air for starting and manœuvring purposes. Under such working conditions, some of the electrical load is thrown off, thereby enabling the compressor to take its additional load. To change over to two-stage working, a hand wheel is simply turned and the intermediate suction pipe is opened to atmosphere, so that this stage then works as a low-pressure cylinder, and the low-pressure cylinder proper is automatically placed out of action. Under these conditions the compressor only supplies sufficient injection air for its own engine, when developing its full electrical output.

A small hand-driven Reavell air compressor is provided for starting in the remote case that the ship is without a supply of compressed air. Air from this compressor is available for the oil-burners of the steam boiler. Steam may then be generated to work the steam emergency air compressor, and the oil fuel transfer pump. It will thus be seen that all possible emergencies have been provided for. At a raised position on the starboard side of the vessel the main switchboard is fitted, and on the same side of the ship there is a roomy and well-equipped workshop, with motor-driven tools and ample bench accommodation for necessary repairs. The workshop machinery includes a 9in. lathe by the Nicholson Tool Company, Ltd., of Newcastle, a drilling machine by Pollard, of London, and an emery wheel grinder.

Other auxiliary pumps also indicated in Fig. 1 include a Drysdale "Centrex" type ballast pump, a centrifugal lubricating oil pump, a geared plunger type oil fuel transfer pump, and the emergency steam and air-driven oil fuel transfer pump already referred to. The refrigerating machinery is installed in a room on the port side of the ship. The engine-room arrangement is particularly roomy in character and bears evidence of careful design.

During the sea trials at which we were present the good running and manœuvring qualities of the ship were demonstrated. Owing to the light condition of the ship in ballast trim and prevailing fog it was not possible to run the engines under full power conditions, but the trial figures showed that the excellent performance of the engines on the test bed, when a fuel consumption of 0.404 lb. of oil per brake horse-power was obtained, are likely to be repeated under service conditions. At a speed of 10.9 knots on the measured mile the engines developed 2398 indicated horse-power at a speed of 85.85 revolutions and the mean temperature of the exhaust was 510 deg. Fah. When the speed of the ship was increased to 11.9 knots the engines were running at 92.5 revolutions per minute and 2752 indicated horse-power was registered with an exhaust temperature of 587 deg. Fah. The trials included a forty hours' non-stop trial, in addition to the measured mile runs. During the slow-running test a speed of 30 revolutions per minute with all cylinders firing regularly was easily obtained, at which engine speed the ship had no steerage way, so that there was no useful purpose served in reducing the speed further. The new design of variable lift fuel valves greatly assisted the reliable running of the engines at low speeds, with a considerable saving in the air required for the fuel injection. Several reversals were made in an average time of six seconds each, and with only two starting receivers and no emergency compressor running, over twelve consecutive starts were obtained with orders given at the rate of two per minute. It is to be expected that even this satisfactory figure will be improved upon when the engineers are more accustomed to the controls.

The Raby Castle is a worthy successor to the motor ships already built and engined by the North-Eastern Marine Engineering Company, Ltd., and we were pleased to note that continued progress is being maintained. In the engine shops work is proceeding on five engines of the double-acting type described in our issue of May 30th last, whilst in the Werkspoor Amsterdam factory no less than twelve sets of engines of the same type are to be built, which is in itself an evidence of the confidence of shipowners in this new and improved form of four-stroke propelling machinery.

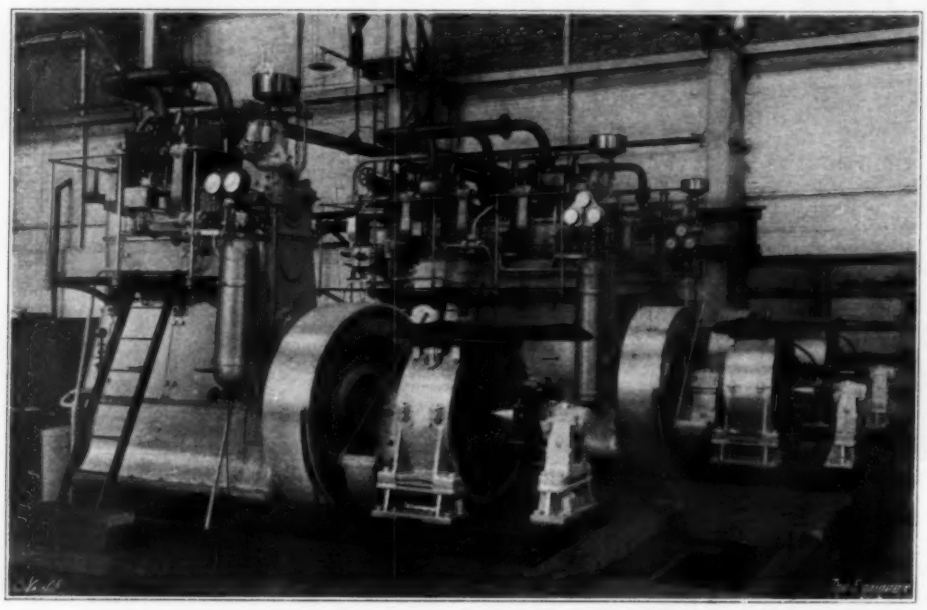


FIG. 4—THE THREE AUXILIARY DIESEL-ELECTRIC GENERATING SETS

BOOKS OF REFERENCE.

The Humber Ports is the title of a handbook just published under the auspices of the London and North-Eastern Railway Company. It has been compiled and arranged by Mr. H. N. Appleby, and it deals with the three ports:—Hull, Immingham and Grimsby. In each case a history of the port is given in addition to a large amount of other information concerning:—(*a*) docks, quays and piers; (*b*) tide tables; (*c*) steamship services; (*d*) regulations and charges; (*e*) dry dock accommodation; (*f*) river quays and jetties, &c. In addition, in the case of Hull, data are given concerning the cold storage available, the graving docks, the coal, fruit, fish and wood trades, sites for works available, &c. Particulars of the railway facilities of the three ports are also included. The book, which is well got up, printed and illustrated, and embodies plans of the three ports, is obtainable on application at the company's offices.

The Colliery Year Book and Coal Trades' Directory, 1925, is published by the Louis Cassier Company, Ltd., 34, Bedford-street, Strand, London, W.C. 2. Price £1 1s. net. As in the present volume, it reaches its third year of publication, it has now become sufficiently well known not to need a detailed description, saving to say that it gives a very large amount of information concerning the collieries of the country and those who are engaged, directly or indirectly, in coal-mining and the coal trade. No new features have been included in this year's edition, but the previously existing features have been amplified and improved.

The Directory of Paper Makers for 1925, which is published by Marchant, Singer and Co., 47, St. Mary-axe, London, E.C. 3, at 5s. net, appears this year—the forty-ninth annual publication—in its customary form. It contains a large amount of useful information, including an alphabetical list of paper and millboard makers in the United Kingdom; of paper enamellers, surfacers, and gummers; of paper makers' representatives and paper agents; of paper mills; and of trade designations, water marks, &c.

SIXTY YEARS AGO.

In our issue of April 21st, 1865, "on the eve of entering upon the great enterprise of Transatlantic electrical communication," we published a full-page table compiled by "the eminent authority, Mr. Gisborne," giving particulars of submarine telegraph cables laid to date. The table showed that, omitting many short lines—of presumably less than 3 miles in length—there were then successfully at work 5066 statute miles of submarine telegraph cables. Pride of place was taken by the 27-mile cable from Dover to Calais, which had been in service for 13½ years. The longest cable in use was that from Malta to Alexandria, 1535 miles, which had been laid in 1861. It was, however, closely approached by the Persian Gulf cable, Bassora to Karachi, 1500 miles, which had been in service for a year. Of cables which had been successful for a time, but which were then not being worked, we gave a list representing a total of nearly 8800 miles. The chief item in this section of the table was the Ireland to Newfoundland Atlantic cable, laid in 1858. This cable had a length of 2160 miles and was worked only for three weeks four days. A note entered against it states that it was probably faulty before it was laid and that the outer covering soon rusted. Another noteworthy defunct cable was that laid in 1860 between Aden and Karachi, 2062 miles, which had a life of only three months. The first cable ever laid is entered in this section of the table. It was the Dover-Calais cable of 1850, a simple gutta-percha covered wire, which was in operation for only one day. In a third section of the table particulars were given of cables that failed while being laid. The total amounted to about 700 miles. In the majority of instances the cables seem to have broken while being laid, but in one the cable ship went out of her course, with the result that the length of cable provided was insufficient to complete the work, while in another the cable was cut to save the ship when bad weather arose.

Railway Matters.

The Halwill-Torrington Railway, in North Devon, the construction of which has been delayed by bad weather, is to be opened about the end of May.

During the year 1924 17 passengers and 107 servants were killed in train accidents on the railways of Canada, as compared with 15 passengers and 122 servants killed in 1923.

It is reported from Stockholm that a new section between Gaefle and Ljusne of the East Coast Railway, connecting the principal places on the North Swedish coast, will be completed during the present year.

The new trains that the London and North-Eastern has put into service for its Harwich boat expresses are provided with Pullman vestibule connections and Buckeye automatic couplings. These are now the standard on that system, as their usefulness in the event of derailment and collision has several times been demonstrated, particularly in the collision of February 13th, 1923, at Retford.

A new type of subway car, equivalent to two of the type at present in use, is provided for in plans and specifications for new cars, costing between 3,000,000 and 4,000,000 dollars, filed by the Brooklyn-Manhattan Transit Company with the Transit Commission for approval. The new type of car, termed a "triplex articulated" model, is made up of three car bodies permanently united and mounted on four trucks. The Transit Company has four of these triplex cars already under construction.

According to latest official information the exploitation of water power in Austria has made considerable progress. The electric railway service has been recently extended to the Arlberg Tunnel. All the Landeck-Bludenz line will be electrified in the course of this year. Up to the end of the year electrification work will be carried on from Bludenz to Buchs and Bregenz, in order to reach the Swiss frontier and link up the Austrian electric system with the Swiss system, which will be electrified in the meantime.

In the article "Railways in 1924," which appeared in The Engineer of January 9th, mention was made of the junction which was being laid in the Metropolitan Railway under the Euston-road outside St. Pancras Station. Its purpose is to allow the Widened Lines to be used by main line trains. From the annual report of the railway company, it seems that up to the end of last year that work had cost £21,070. Up to the same period the electrification of the line between Harrow and Rickmansworth had cost £84,577, and the burrowing junction for the Uxbridge branch lines at Harrow £19,136.

In addition to the construction of a subway between the Estación del Mediodia—or de Atocha—and the Estación del Norte—or del Principe Pio—in Madrid, plans have been presented to the authorities for the erection of a large new central passenger station on a site between the Plaza de Red de San Luis and the Plaza de Callao, on the Gran Via. The building will occupy an area of 47,000 square feet. In addition to the usual departments there will be a large hotel with accommodation for not fewer than 250 guests. The plans have been completed, and are now being considered by the Administration.

The unfortunate *contretemps* which attended the opening on April 1st of the extension of the electrification of the Brighton section of the Southern Railway, led to the Minister of Transport being asked, "Why the live-wire system had lately been extended in disregard of the fact that the live-rail was the standard system of electrification for railways in the London area. Colonel Ashley, in reply, quoted the opinion of the Electrification of Railways Advisory Committee, as expressed in its *interim* report, that it was advisable that the remainder of that particular electrification should be on the overhead system.

Questions addressed to the Minister of Transport, which suggest that the pneumatically-operated doors on the cars of the tube railways in London are a source of danger, must be viewed with suspicion, inasmuch as they may be prompted by an ulterior motive. These doors are self-closing and are pneumatically locked from the guard's compartment. The locks cannot be operated until the doors are closed and the signal to the motorman to start cannot be given unless and until all the doors are locked. Thus, no one can enter a car after the signal to start has been given. Of course, no passenger can alight until the guard has unlocked the doors. The arrangement dispenses with the necessity for any gatemen on the intermediate cars, and so the number of trainmen is reduced, and therein lies a possible motive for suggesting that the pneumatically-operated doors are dangerous. Such a question was recently addressed to the Minister of Transport, who replied that the officers of the Ministry have had the doors referred to under close observation during the three or four years they have been in use, and are satisfied that safety requirements are fully met.

Possibly because the incident occurred on the much-abused Southern Railway considerable attention was paid by the daily Press to the fact that last week a train for Sevenoaks was turned at London Bridge on to the wrong line by a signalman who thought its destination was Redhill. The train stopped at the first station, and the trainmen were there told to proceed *viâ* Redhill and Tonbridge. An official inquiry was subsequently held, and a public announcement made that "the action taken, once the initial mistake had been made, caused the least inconvenience to the general public, as no other delay was experienced through the incident. As it may not be clear what would have been the effect of bringing the train back to the C. box at London Bridge in order to get on to its right road, we would say that at Spa-road, where it pulled up, the engine would have had to be detached, have had to set back through a crossover road on to the up line, backed thence to the signal-box in the rear of its carriages, and then through a cross-over road on to the down line and forward to the rear of its train. The latter would afterwards wards have had to go through the crossover at Spa-road to the up line, run thence to C. box, where the engine would again have had to run round its train. These operations would, we estimate, have occupied some 40 or so minutes, and, meanwhile, all traffic on both lines at Spa-road and C. box would have been at a standstill.

Notes and Memoranda.

It is said that the rock-fill dam now being built on the Dix River, Kentucky, is the largest of its kind in the world. It will be 1020ft. long by 275ft. high, and will contain 1,747,000 cubic yards of rock, excavated from the spilway. It will be faced with 8in. of concrete.

For the purpose of dislodging fixed accumulations of slag in rotary cement kilns a Chicago firm is, according to the *Literary Digest*, using a sporting gun and a charge of 1 oz. of lead shot. As compared with the process of stopping the kiln and letting it cool down sufficiently for men to enter, the shooting method is said to effect a saving in the proportion of 50 dollars to 1000 dollars.

According to an article by Mr. Neil Collins in the *S.A. Mining and Engineering Journal*, it seems likely that certain of the alluvial platinum fields in the Northern Transvaal will be worked by means of dredgers, and this method is suggested in the prospectus recently issued by the Lydenburg Consolidated Platinum Company, whose engineer states that a great deal of their land is likely to prove suitable for working in this way.

The bell which is to be installed to strike the hours at Bristol University is 10 tons in weight, and is, says the *Ironmonger*, the fourth largest bell in the country. It was made at Loughborough. The largest bell in England is "Great Paul" at St. Paul's Cathedral, the second "Big Ben" at Westminster, and the third "Great Peter" at York Minister. Bristol's new bell displaces, as the fourth largest, that at Manchester Town Hall.

Two remarkable oceanic ventures are described in a recent issue of the *Christian Science Monitor*. One is a French proposal to provide four floating islands on the Atlantic to serve as bases for aerial transport. The islands would be 450 yards long by 230 yards wide and cost some 200 million francs each. The other scheme hails from America, and contemplates the dispatch of a steamer to roam about the oceans for the sole purpose of extracting bromine from the sea water.

In view of the commercial success that has attended the establishment of titanium white industries in Norway and the United States, the question of the possibility of establishing a similar industry in Eastern Canada, where all the necessary raw materials are readily available, should have considerable interest for industrialists on the lookout for new opportunities. Large deposits of cheaply minable ilmenite carrying 35 to 40 per cent. of titanic acid are easily accessible from tide water on the north shore of the St. Lawrence River, in the province of Quebec; workable deposits of barytes occur in Nova Scotia, Ontario, and Western Quebec; sea-borne Nova Scotian coal, as well as barytes, is available; and electric power is abundant and cheap.

Coke samples may be pulverised to pass a No. 60 sieve for laboratory analysis by means of Abbé ball mills with flint pebbles, roll crushers kept in good condition and with the rolls rotating at the same speed, or by impact in a hard steel diamond mortar without any appreciable contamination from the grinding apparatus. Grinding apparatus, such as disc pulverisers or bucking boards, are likely to contaminate appreciably the coke by introduction of iron from the abrasive action of the coke on the rubbing surfaces. The pulverising of any quantity of coke by impact in a hard steel diamond mortar is tedious and takes considerable time. Ball mills or roll crushers appear to be the most practical methods for pulverising coke to pass a No. 60 sieve.

According to an article in *Engineers and Engineering*, a copper-steel alloy may solve the problem of providing a non-corrosive transmission line pole. In order to determine the exact value of copper alloy in steel a series of exposure tests on unpainted sheets, both with and without a copper content, has been conducted. These tests have been carried over a period of sixty-four months and are being continued. The test sheets are of 22-gauge thickness, or approximately $^1/_{32}$in., and in order to make the tests as severe as possible localities were chosen where the atmospheric conditions were most trying. The sheets containing no copper began to fail in ten months and completely failed in sixteen months. But those having a copper content of .25 per cent. are still in perfect condition, although they have suffered a slight loss in weight.

In the formation of couples for thermo-electric pyrometers there is a steadily increasing use for platinum. Other uses include the manufacture of sulphuric acid by the contact process. Platinum is also used in photography, and in various chemical processes, although owing to the recent high price various substitutes have been experimented with. In combination with iridium, it is largely used as a tip for fountain pen nibs. It is also used for lightning rod tips, colouring pottery and the preservation of standards of measurement. Dentists use it because it neither tarnishes nor oxidises, and its value in chemical laboratories is explained by the fact that no acid other than *aqua regia* affects it. The qualities that make this metal so extremely valuable in these and many other purposes are its high specific gravity, high melting point, malleability and ductility. The melting point of platinum is 1755 deg. Cent.

During the last ten years a very rapid development has taken place in Germany in the design and the general use of large motors for rolling-mill drive. Up to the end of 1914 the Siemens works had supplied motors, with an aggregate capacity of 600,000 kilowatts, which output rose to twice this amount within the next ten years. Older installations had main motors with two or even three armatures, while the present trend seems to be more toward single-rotor machines. The Ilgner fly-wheel motor-generator system and the Leonard method are standard. To keep the current low, direct-current main motors, working at a pressure as high as 1500 volts per motor are not uncommon. A great improvement on three-phase driven Ilgner sets is a scheme assigned to utilise the previously lost slip energy of induction motors by employing a commutator machine which feeds this energy mechanically back into the shaft of the control motor. There are at present single-rotor motors in operation with a maximum torque of 275 metre-tons and double-rotor motors with 330 metre-tons.

Miscellanea.

The International Exhibition at Grenoble will be opened officially on Thursday, May 21st.

The output of arsenic in Southern Rhodesia during the year 1924 amounted to 588 tons, valued at £20,780.

The Corporation power plants of Huddersfield and Halifax are to be linked up by means of a pair of 33,000-volt cables, so that the two stations can share the peak load, and either one can be shut down during times of light load.

The exhibition of the Model Railway Club, which was held in the Kingsway Hall, Kingsway, on Friday and Saturday, April 17th and 18th, was as crowded as usual with enthusiastic amateurs. The models exhibited were principally of the clockwork type, and made by trading firms, but there was a fair proportion of amateur work, and some excellent examples of track work.

Colombo will soon have a modern high-power broadcasting station. The range will easily cover the whole of Ceylon. The studio and control room of the new station will be situated in the Fort, and will be connected by land line to the Welikade Station, where the actual broadcasting will be effected Arrangements have been made to install a microphone of a type which will eliminate distortion.

It was stated at a Ministry of Health inquiry at Doncaster on April 8th that the Markham Main group of collieries intends to sink a new pit at Awkley, and, if that materialises, there will be, it was added, a village of from 5000 to 10,000 population. It was further mentioned that a colliery village is to be erected at Micklebring, which, it was estimated, would add between 5000 and 10,000 to the population of the area.

According to the *Commonwealth Engineer* of February 1st, the Western Australian Government is finding difficulty in filling the positions of Engineer-in-chief and Hydraulic Engineer. It has now been decided to defer the appointments until the Premier (Mr. P. Collier) has had an opportunity of making inquiries in Great Britain. Mr. Collier was a passenger by the R.M.S. Orama, and it is probable that Mr. Jas. Thompson, the retiring Engineer-in-chief, will go to London to assist in the selection.

The Irish Free State Ministry for Industry and Commerce has appointed a Committee to consider and report whether it is practicable to produce in the Free State crude alcohol at a price and in quantities that would enable it to compete with imported spirit for power purposes, and whether it is possible to produce commercially an efficient type of engine using crude alcohol that would be suitable for commercial power requirements. The Ministry offers prizes up to £1500 to persons who can demonstrate that the production of crude alcohol and of an efficient engine is commercially practicable.

It is announced from Montreal that Professor Henry M. Lamb, Associate Professor of Civil Engineering and Lecturer on Architecture at McGill University, died on April 1st. Professor Lamb had been a member of the staff of the University in 1907, when he was appointed Demonstrator in Surveying and Descriptive Geometry. After filling other posts, he was appointed in 1920 to the position he occupied at his death. Professor Lamb's death is regarded as a severe loss to the University. His services were frequently in demand by leading Canadian engineers in connection with difficult technical problems.

The new showrooms and stores erected by the West Bromwich electricity department were formally opened on April 20th, when an inspection was made by members of the Council, who were afterwards entertained to tea by the Committee. An inspection was also made of the new plant which has been recently installed at the works at Black Lake. Mr. J. Bell, chairman of the committee, said the department was now able to cope with a 50 per cent. larger demand from manufacturers, but he was sorry to say that the increase for last quarter was only 10 per cent., whereas for the corresponding quarter last year it was 26 per cent.

At the present time the largest double-acting marine oil engine built in Great Britain is undergoing shop trials at Harland and Wolff's Belfast works. It is of the Burmeister and Wain four-cycle type. The engine under test is an eight-cylinder unit, designed for an output of about 10,000 brake horse-power when running at a speed of between 110 and 120 revolutions per minute. Ten engines of this design are under construction at Harland and Wolff's works, six of which will be of the eight-cylinder type. Two of the first engines to be completed will be installed in a 22,000-ton passenger liner which the firm is building for the Royal Mail Steam Packet Company.

The thirty-eighth exhibition of specimens of turning in wood and metal under the auspices of the Worshipful Company of Turners, a preliminary notice of which appeared in The Engineer of April 3rd, was opened at the Mansion House on Wednesday, April 22nd, and remains open until 2 p.m. to-day. One of the most striking features about the exhibits is the high standard of accuracy attained by lads of about fourteen years of age in turning metal, both with the slide rest and by hand. There are a few very fine examples of work by master-men and apprentices, while the wood turning class is extensive. In the opinion of the judges the work of the amateurs compares very favourably with that of past years.

The failure of a hillside reservoir at Skelmorlie, Ayrshire, on Saturday afternoon last, caused the death of five persons and considerable damage to property and roads. The reservoir was the lower of two, which are situated on the Eglinton estate above Skelmorlie, and it had a normal capacity of about 3,500,000 gallons of water. It was used to supply the village with water, and was constructed forty-seven years ago. The failure took place along the south-west side, facing the sea, and about 30ft. of the embankment was broken down. At this part the bank was composed of earth and grass, and lined with stones up to within a few feet of the top. It is supposed that an unusually high level of water washed away the top part of the earth embankment, which then allowed the lower part of the wall to give way.

IRRIGATION WORKS IN AUSTRALIA

(*For description see page 465*)

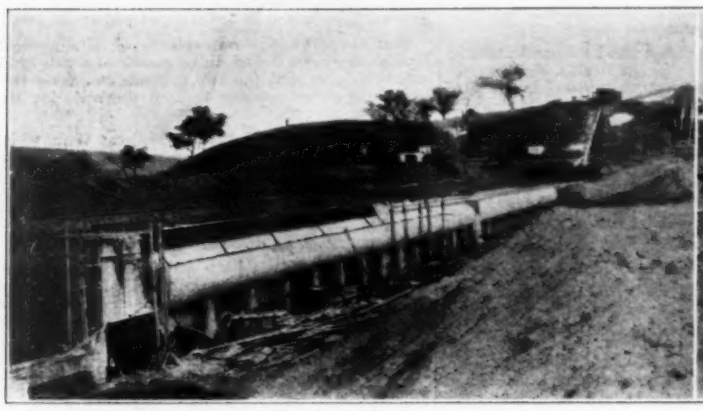


FIG. 1—HUME RESERVOIR—REINFORCED CONCRETE CORE WALL

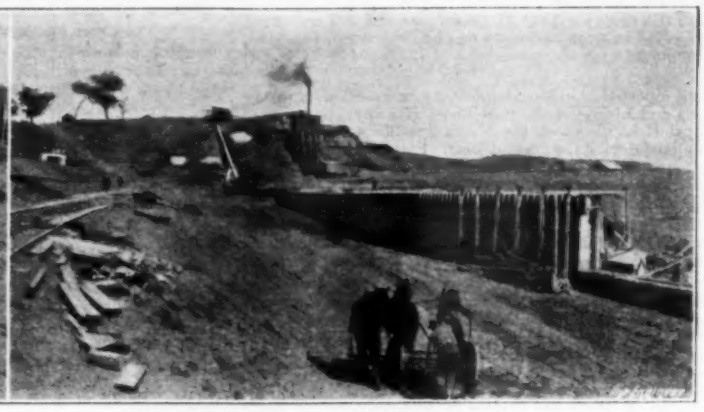


FIG. 2—HUME RESERVOIR—UPSTREAM VIEW OF CORE WALL

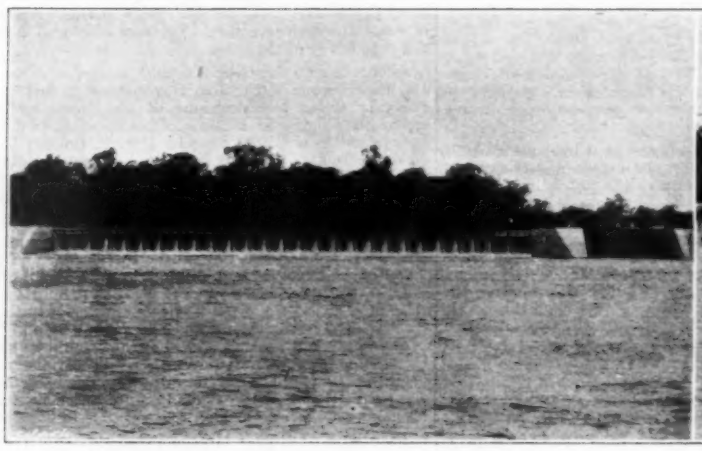


FIG. 3—TORRUMBARRY WEIR AND LOCK

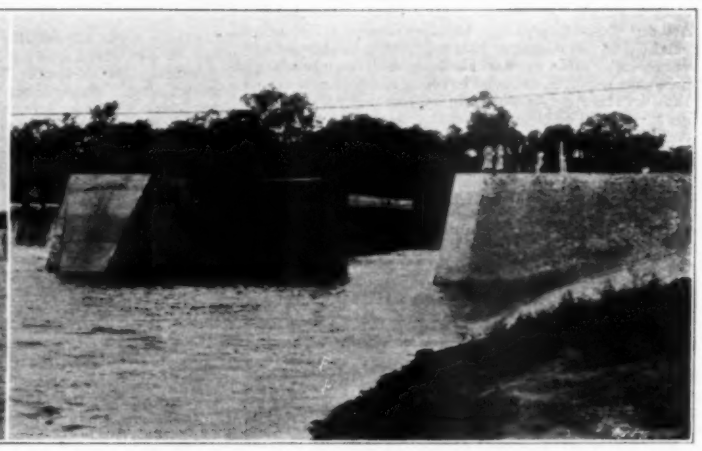


FIG. 4—TORRUMBARRY LOCK FROM DOWNSTREAM

FIG. 5—TORRUMBARRY WEIR—TRESTLES IN POSITION

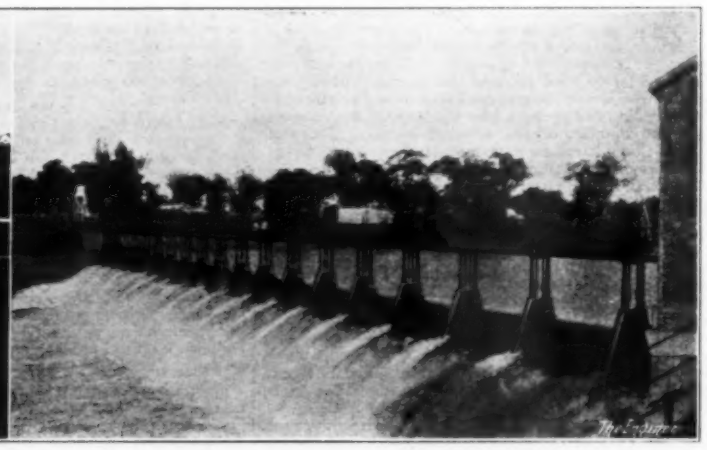


FIG. 6—GOULBURN WEIR, LOOKING UPSTREAM

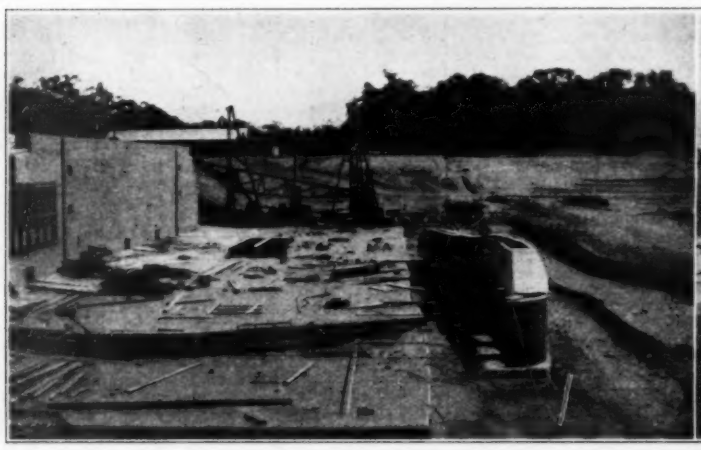


FIG. 7—TORRUMBARRY LOCK UNDER CONSTRUCTION

FIG. 8—TORRUMBARRY LOCK, LOOKING DOWNSTREAM

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The Engineer

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By arrangement with Reuter's Engineering Service, **The Engineer** *contains the latest news from all parts of the world which is likely to be of interest to engineers.*

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Sixteen-page Supplement—"The Metallurgist."

DEATH.

On the 20th April, suddenly, after an operation in a London nursing home, James Patten Barber, M. Inst. C.E., for 43 years borough engineer of Islington, aged 69.

The Metallurgist

THE APRIL NUMBER OF THE MONTHLY METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.

THE ENGINEER.

APRIL 24, 1925.

The Use of Electricity.

That the people of this country have not yet realised the advantages of electricity is an opinion which is often expressed, and it sometimes appears from the remarks of those who are in the habit of speaking on this matter, that little beyond an extensive publicity campaign is necessary to make the electricity supply business thrive. But there are, of course, other obstacles to progress besides the alleged failure of the British public to appreciate what electricity can do. While propaganda is essential to the growth of electrical engineering, it will not reduce the cost of wiring houses or of installing appliances. As far as lighting is concerned, there is not much doubt that the majority of people are already convinced that electrical illumination is the best, and it would unquestionably be adopted on a much more extensive scale if it were not for the cost of installing it. At the recent annual luncheon of the British Electrical Development Association, a good deal was said about educating the public, which, of course, is the *raison d'être* of the Association. Unfortunately, however, the introduction of electricity involves the expenditure of capital, which under present conditions the landlord is not prepared to provide, whilst the tenant, even if he can afford to do so, is reluctant to spend money on improvements which may result in an increased rent when the present restrictions are removed. According to Mr. W. B. Woodhouse, probably less than 20 per cent. of the houses in this country are wired and connected to the public supply. The reason for this state of affairs is, not that people do not want electricity, but that they cannot see their way clear to go to the expense of wiring and equipment. Nothing is more important to electrical progress than for the supply undertakings to help would-be consumers to equip their premises. The cost of the current must also be reduced, and, in some cases, very considerably. Let the electrical industry spend money on propaganda by all means, but let it remember that there are other matters which demand attention as well as educating the public.

We are glad to note that the Electricity Commissioners have appointed an advisory committee to investigate and report on certain matters relating to domestic supply. One of the questions to be considered is what steps are being made by authorised undertakers to encourage and extend the use of electricity for domestic purposes, and what further steps could be taken to bring about an increased consumption for those purposes. The formation of this committee, it is to be hoped, will do much to stimulate the consumption of electricity in this country, and will serve, we trust, to remove much of the apathy that has hitherto existed among electricity supply authorities. The question of increasing the use of electricity for domestic purposes is obviously of paramount importance to manufacturers of large power plant, as well as to those who supply domestic appliances. With the wiring difficulties removed and cheap supplies made available in all parts, there is not much doubt that the people of this country would take to electrical methods without very much education, and the demand upon the industry would very soon become great. Equally important is, of course, the application of electricity to industry, but here again progress leaves much to be desired. Sir Benjamin Longbottom has recently shown that within recent times the demand for electrical plant from general industry has been moribund, a fact which is one of the most disquieting features in the economic position of the electrical trades. While little has been accomplished of late in the way of equipping the factories of British industrial concerns with new electrical or other plant, Germany, it seems, has done a good deal in that direction. In a recent letter to *The Times*, Sir Philip Dawson contends that one of the main causes which enabled the Deutsche Werft to quote such a low price for the ships recently ordered by the Furness-Withy group was that since the war the firm has designed and installed plant for the special purpose of producing definite types of ships. Yet in this country, where there are now undoubtedly many factories which are very imperfectly equipped, the manufacturers who are in a position to supply modern plant cannot get orders. Germany, with its great industrial combinations, working in close co-operation with its banks and supported by the active intervention of its government, has put British industry in the position of having to wage a most unequal contest; and we agree with Sir Philip that new methods must be adopted if our present difficulties are to be overcome.

Electricity will not cure all industrial ills, but it can undoubtedly render in many instances great assistance to manufacturers, and it is a pity that its application to British industry is not making more rapid progress. In the mining industry alone there is still very great scope for the electrical manufacturer. In order to keep pace with other countries British industrialists must take advantage of everything that tends to reduce the cost of production, which is now the principal difficulty, and if it can be shown that electricity is advantageous for a specific purpose every endeavour should be made to adopt it.

Minor Failures.

The occurrence of breakages or failures in service is, happily, comparatively rare. When the many millions of stressed parts employed in regular service, often under very unsatisfactory conditions, are taken into consideration, there is good reason for engineers to be proud of the smallness of the number of breakdowns which occur. For instance, in a striking little speech at the luncheon of the British Non-Ferrous Metals Research Association a few weeks ago, Sir Robert Dixon, Engineer-in-Chief of the Fleet, gave some remarkable figures in regard to the condenser tubes of the Special Service Squadron, which has recently completed a tour of the world. The ships of this squadron carried, in all, about 160,000 tubes; they were under steam for ten months, and yet during that period only five tubes gave out. Yet, in the face of such excellent results, Sir Robert added that the problem of condenser tube corrosion was still regarded as a serious matter. Coming from one so well qualified to speak on such a point, this remark serves to emphasise the fact that even minor failures, occurring only at rare intervals, may be, and indeed often are, of very serious importance. The more important or striking cases, which lead to a sensational breakdown, or even to a serious accident, usually receive all the attention they deserve. Public inquiries are often held and full

investigations made, and there can be no doubt at all as to the ultimate benefit arising from the careful study of these cases. What we wish to point out, however, is that in their sum the numerous minor failures and breakages probably lead to greater loss—both of money and of life—than more prominent but rarer accidents.

Let us take as an example the mining industry. Unhappily, that industry, particularly coal-mining, is subject from time to time to mishaps involving large loss of life. Disasters of this kind, however, have been systematically studied and steady improvement has been made, so that the toll of life is, on the whole, markedly reduced. We understand, however, that even in this industry minor mishaps account for more loss by injury and even by death than results from the occasional sensational disasters. By no means all of these minor accidents can be ascribed to engineering failures, since the human element of carelessness, bred from familiarity and consequent indifference, unhappily plays a large part in them, and is extremely difficult to control. With such accidents we are not now concerned. It is of such events as failures in hauling gear and mishaps arising in connection with underground transport that we wish to speak. It is far from our desire to throw blame on the engineers, who, heavily burdened with responsibilities and duties, are in charge of the working of such gear. What we wish to urge is that cases of minor failure —the breakage of a chain, a rope, a shackle link or similar part—should not be passed over lightly, even where no serious results have followed. The causes which have produced one breakage may, if they are not sought out and carefully eliminated, cause others of a more serious nature. We fear, however, that as a rule these minor breakages receive comparatively little consideration. If the failure is not dismissed with the mere remark that "this must have been a bad one," little more results than, perhaps, a complaint to the maker. The maker may or may not know the real cause of the failure, and may or may not be willing either to disclose it or to take the necessary steps—perhaps difficult—to prevent a recurrence. If the failure is only occasional, his answer will usually be to point to the excellent service which the great bulk of his products is giving. From the immediate commercial point of view, such an answer is sound and adequate, since no product of human hands can be expected to be uniformly perfect. But the real question at issue is not whether or not the maker can be blamed for the failure. There is no question of "blame" at all, but of securing the necessary knowledge which shall make it possible to avoid these minor mishaps in the future. The remedy does not always lie in the hands of the maker; conditions and duration of service may have been unduly severe, the design may be open to serious criticism, in spite of the fact that failures occur but rarely, or the workmen may have abused the part in question. On the other hand, the material may be at fault; it may have been unsatisfactory to start with, or have been damaged at some stage in the process of manufacture. If, however, the breakage is in itself relatively unimportant; if the cost of the article, or the immediate consequences of an individual failure are not serious, none of these points receive adequate consideration, and the whole matter is, at most, the subject of some business negotiations or adjustments. When a little more attention is given to the matter, it may perhaps become the subject of examination by the foremen and engineers on the spot. These are, generally, men of great specialised experience in their own particular line of work, but that line is not, as a rule, the study of the causes of breakages. Yet their judgment on the cause of failure is frequently the only one that is invoked, and, almost inevitably, the real source of the trouble goes undetected. Where exhaustive public inquiries have been held in more obviously important cases, the result has nearly always gone to show that the judgment of the local experts could not be relied upon, except in those cases where failure arose from abuse or neglect.

We do not, of course, wish to suggest that exhaustive public inquiries should be held in every case of minor failure. Such a course would be absurdly impossible. What we do urge, however, in the interests alike of safety, economy, and the progress of engineering, is that cases of minor failure should not be passed over as unimportant. Wherever it is at all possible to do so, every effort should be made to trace the real causes of breakdown, whether they reside in the material, the design or the mode of use. The time and money devoted to such work would be amply repaid in the gradual diminution of these minor failures, with their attendant losses of time, of money, and, in the sum, of many lives. The difficulty lies, probably, in finding the money for work of this kind, but it is, we consider, a matter not only of interest to the whole of our great industries, but also of general public importance. We cannot afford waste in our industrial life, and minor mishaps are a serious source of waste. Unfortunately, however, such work is not the immediate concern of any one particular firm or individual, and what is everybody's business is apt to be neglected. Would it be possible for one or several of our great engineering institutions to set up an organisation to deal with such problems? National aid, as, for instance, from the Department of Scientific and Industrial Research, would be fully justified. It is a case of many small things, many of them apparently unimportant, which at present are often neglected or even purposely pushed aside. Yet the exhaustive study of these things should furnish knowledge of a kind able to render many of our industries both safer and more profitable.

The Sale of Coke by Analysis.

Under the stress of contemporary circumstances many of our industries are undergoing what is called "speeding up," all possible sources of economy coming under careful consideration. One such economy which has found favour in the eyes of ironmasters is the purchase of coke by analysis, instead of by reputation or by the current market quotation. The shilling or so a ton which some cokes fetch in excess of the price paid for others may doubtless be justified by analysis, though, of course, the possibility exists that the new procedure may result in upsetting ideas which have long been current. As the advantage of the new move is all on the side of the buyer, it is not unnatural that some, at any rate, of the producers fail to exhibit enthusiasm. Indeed, we believe we are right in saying that they view the proposal with the gravest doubt, though refraining from active opposition to it.

The reason given by the producers' association in an important district where the matter has been and is still, we understand, under discussion, is the difficulty to be apprehended in correct sampling. It is common knowledge that the ash in coke is not evenly distributed; that, in fact, a piece of furnace coke will show considerable variations in ash content in different parts. This, of course, is not an insurmountable difficulty, but it indicates clearly that grab sampling will not lead to satisfactory results, and that the sampling will perforce have to be carried out on a considerable quantity of material, and by a trained sampler, if disputes are to be avoided. Presumably, the sampling will take place at the buyer's works, and if a referee sampler is not agreed upon, the work will be done by joint samplers appointed by the buyer and seller. If a representative bulk sample is taken, its amount will have to be decided upon beforehand, and an agreement come to as to whether, for instance, five per cent., one per cent., or one hundredth per cent. of the delivery is to be taken and broken down. Sampling costs money and expenditure upon it must figure in the profit and loss account of the new proposal. *Prima facie*, the lower the ash content of blast-furnace coke, the higher the calorific effect, and as a German expert has expressed the opinion that one per cent. increase in ash means two per cent. loss of coke efficiency, it is not surprising that the ironmasters wish to penalise the coke producers for excess of ash. The new scheme is that coke shall be sold on a ten per cent. ash basis, and that if the ash should be eleven per cent., a reduction of, let us say, sixpence per ton as being not far from the mark should be made in the price. Conversely, if the ash should turn out to be eight per cent., the buyer would have to pay a further shilling per ton. What the arrangements, if any, as regards water, sulphur, or other components of the coke may be, we do not know. A difference of one per cent. of ash in the coke is thus seen to be equivalent to £25 on a thousand tons, a matter which in these strenuous times may be considered of importance.

Although this proposal has not yet generally materialised, yet in West Cumberland and one or two other districts it has already come into practice, and the probability is that it will become very general when the present objections of many of the coke producers have been overcome. Coal, of course, comes in a different category, and although most collieries are ready to give potential purchasers a copy of the analysis of their output, they would strongly oppose any suggestion to sell on a basis of ash content, and, in truth, in that way would disaster lie, because they have to sell what comes out of the pit without having time to go closely into the composition of the coal. With coke, as we have indicated, the case is different, and assuming absence of disagreement over sampling, the new scheme seems to be a desirable development.

Literature.

A Manual of Locomotive Running Shed Management. By W. Paterson, M.I. Loco. E., and H. Webster, B.Sc. (Lond.), M.I. Loco. E. London: Charles Griffin and Co., Ltd. Price 15s. net.

The object of this work is to describe how locomotive steam sheds should be managed and also how locomotives should be cared for and their operation controlled in order that they may be most efficiently utilised. This is an ambitious aim and one which, if covered in its entirety, would certainly present a formidable task. The manual on this subject under notice seeks to accomplish the object in a comparatively small volume of 200 pages, which include three taking the form of a general index and a further seven of tabulated information. There are in all thirteen chapters, which are so compiled as to deal with the specific details which are more or less akin to one another. As a case in point Chapter VI. may be mentioned as dealing with Coal, first of all, its composition, then coaling methods, storage, and notes on other fuels.

In order to indicate the scope of the work we may briefly refer to the contents of each of the several chapters. In the first the Staff *Personnel* and Organisation and matters such as Uniform and Staff Welfare are discussed. Chapter II. deals with Enginemen's Classes, &c., and in the third chapter we find a discussion on the Lay-out of Running Sheds. Following in No. IV. matters such as Messrooms, Dormitories, Lighting and kindred subjects are mentioned. In No. V. Stores and Engine Tools and matters relating to the Issuing of Stores of different kinds are dealt with. Chapter VI. deals with Fuels and Chapter VII. is devoted to the complex subject of Engine Mileage. In VIII. Engine Cleaning and Preparing is considered, and in IX. Engine Working Diagrams and such matters are gone into. Chapter X. is on the subject of Repairs, and the remaining Chapters XI., XII. and XIII. deal with Engine Failures, Derailments, Breakdown Trains and their Equipment, Trials and Tests and the Inspection of Material Failed in Service.

The work is of considerable interest and, as will be gathered from what has been said, is remarkably full of information on the problem of locomotive management. One has but to study it to appreciate the large amount of work necessary and the large staff—beyond the numbers of enginemen—required to prepare and maintain steam locomotives for work on the road, and to keep all the records that are required to enable the service obtained from individual engines to be appreciated. The chapters dealing with the arrangement of running sheds and their equipment are those which attract us most, chiefly because they indicate clearly that up-to-date methods may be known to those who are responsible for their design and construction, and also because we very well know that in many instances they are entirely lacking. We fully appreciate all the work entailed in the proper management of the locomotive stock of a railway, and always insist that it is of little value to build large and efficient engines if they cannot be kept in service simply through lack of facilities at the sheds. The classes for enginemen, the subject of which is fairly fully considered in Chapter II., are of great importance, and we are glad to see that fair space has been rightly given to this subject. The economical performance of the locomotive very largely depends on how it is handled by the enginemen. Of course, some engines cannot be operated in an economical manner whatever the driver and fireman may do. That, however, is due to faults in design.

We imagine that the authors of this volume will be well satisfied if their work is to be found on the bookshelves of the junior outdoor officials of our railways, and we recommend it both to them and to others who either control, or aspire to control, the running of railway locomotives. There is undoubtedly a large amount of useful information in its pages, not only in the text, but in the illustrations, which, while being by no means elaborate, are very fair. In certain instances they could have been larger and thus more comprehensive with advantage.

Notes and Data on Railway Engineering (Ways and Works). By Frank Reeves, M. Inst. C.E., &c. London: Charles Griffin and Co., Ltd. Price 15s. net.

This volume is made up from a collection of notes on the many problems which present themselves in the every-day work of the engineer who has to plan and build a new railway. All the information given has, according to the preface, been reduced from notes of an extensive character. The work is arranged in alphabetical sequence, and is thus a small encyclopædia on the subject, and as such is undoubtedly very con-

venient. It is a practical book for the practical man, and those illustrations which it possesses are well made and are fully dimensioned, which gives them additional value.

Many of the sections are very instructive, and we would especially mention those on the subject of the creep of rails, the construction of culverts, and derailments. In connection with the subject of derailments, we are interested to note the author's remarks on page 69, where he says that "bogie vehicles rarely derail from irregularities in the track even when this is of the most atrocious order—passenger bogie vehicles hardly ever." We are glad to note this statement, because in our journeys on railways in different countries we have at times feared that the train would leave the track, so bad was it in parts. The fact that we were not derailed at quite fair speeds—40 to 45 miles per hour—bears out Mr. Reeves' statement.

The volume is one that should be found with other works on this subject in the possession of railway engineers engaged either in the development of new or the maintenance of existing lines.

The Theory and Design of Structures. By EWART S. ANDREWS, B.Sc. Eng., Assoc. M. Inst. C.E., M.I. Struct. E. London: Chapman and Hall, Ltd. Fourth edition. 1925. Price 13s. 6d. net.

SINCE this standard work is written for students and draughtsmen as well as for engineers, this edition, so moderately priced, will be a boon to many. The subject is not one in which important developments have taken place since 1908, the date of the first edition, except with respect to the strength of columns, to which the author devotes some additional space in an appendix, with useful diagrams relating to excentric loadings, slenderness ratios, and so forth. In another appendix there are tables of the properties of British Steel Standard Sections, 1920, as well as of the old standard sections, which, as the author remarks, will remain on the market for some years.

In other respects this edition is the same as the third, with the correction of some minor errors, and no extended review of so well-known a work is necessary. For the benefit of students, however, it may be as well to point out that, wide as is its scope, there are one or two subjects which are not included or are dealt with very briefly. Only nine pages, including diagrams, are devoted to masonry dams, and the only type considered is the mass gravity dam, regarded as a type and with reference to the calculation of its cross-section, but without reference to the reactions of abutments or foundations. There is no reference to arched dams or to multiple arch dams. The calculations for the arches could, of course, be made with the help of the pages devoted to arches considered generally and to masonry arches, but this information and that in the two pages given to buttresses do not provide the equipment needed for the design of a multiple arch dam. Mr. Andrews' judgment in thus limiting his treatment of masonry dams is not questioned, but it seems desirable that the fact should be noted. The printing of this edition has been well done, and the diagrams, though in some cases somewhat small, are, on the whole, clear, and the figures legible.

Irrigation Enterprises in Australia.

IN no state in Australia has the great value of water conservation and irrigation been more markedly demonstrated than in Victoria, where immense areas of dry country, which under natural conditions could sustain only a sparse population, have been converted into farms and holdings of great productivity.

HUME RESERVOIR.

Amongst the most important of the schemes now in progress are the Hume storage works, which are being carried out jointly by the states of New South Wales and Victoria, and are included in the works authorised by the River Murray Waters Acts. The site of the Hume dam, which is on the Upper Murray, just below the junction of the Mitta River and 6 miles due east of Albury, New South Wales, was adopted as being the most suitable, having regard to foundations, storage capacity, cost of construction, and of lands to be submerged.

From information concerning this interesting undertaking, which was supplied recently by Mr. H. H. Dare, M. Inst. C.E., it appears that the catchment area above the site is 5900 square miles. The underlying formation is solid granite overlaid by a considerable depth, in some places, of decomposed granite. On the Victorian side there are extensive alluvial flats. The total length of the dam will be about 3600ft., of which 2700ft. will consist of an earthen embankment, and the balance of a concrete spillway and outlet works. As proposed, the maximum depth of water impounded will be 90ft. in the river section, while over the flats on the Victorian side the average depth will be about 73ft. The water surface at full supply level will extend to 30,000 acres. The latest estimate of the cost of the dam is £2,577,000.

Provision has been made in the design for discharging 100,000 cusecs. The earthen section will have a width of 32ft. on the crest, which will carry a roadway and have slopes of 3 to 1 upstream and 2½ to 1 downstream, hardening to 2 to 1 for the top 12ft. on both sides. A core wall of concrete is being constructed with foundations carried down into the underlying granite. This wall is reinforced with steel rods, and is provided on the downstream side with an inspection gallery which will admit of observation of the behaviour of the wall after the dam is filled with water. Selected material, specially consolidated, is being packed on each side of the core wall. The upstream face of the dam will be protected by a layer of rock packed in place with rubble grouted in with cement or reinforced concrete, as may be found most desirable.

The spillway section will be constructed in the existing river bed, extending towards the New South Wales bank. It will be constructed of concrete gravity section, and will be curved to take advantage of the most favourable rock levels. On the crest of the concrete wall will rise thirty piers to carry the roadway, and to serve as abutments for thirty-one movable shutters, each having a 20ft. clear opening and a 15ft. rise. These shutters will be lowered on sliding guides on the upstream face of the dam, when it is desired to discharge flood waters. In order to deal with the flow of the river during construction, it is proposed to provide two tunnels, each 20ft. by 20ft., or thereabouts, closing the tunnels by means of reinforced concrete bulkheads on the completion of the work. A view showing the placing of the reinforcement and concrete in the core wall is given in the engraving herewith, while two views of the dam under construction are given in Figs. 1 and 2 on page 462.

The work on the Victorian side is being carried out under the direction of the State Rivers and Water Supply Commission; that on the New South Wales side, including the river section, under the direction of the Minister for Public Works. A connection is made between the two sides of the river by means of a timber bridge. A quarry of excellent granite has been developed on the New South Wales side somewhat upstream of the work. On the New South Wales side compressed air for the operation of the quarry drills is supplied at a pressure of 100 lb. per square inch. Eight-ton quarry cranes, of the self-propelling type, are employed on the quarry floor for loading displacers for use in the concrete and also for loading trays of stone for the crushing plant. A steam shovel also assists the latter operation. The crushing plant includes a 36in. by 24in. jaw crusher, in which the stone is broken to a maximum dimension of 9in., and two gyratory crushers operated by a 250 brake horse-power cross-compound high-speed steam engine, to which steam is supplied by a Babcock and Wilcox boiler.

The capacity of the plant, both at the quarry and at the dam site is designed on the basis of 1000 cubic yards of concrete placed in position per eight-hour day. From the storage bin the stone is delivered to trucks running on a 3ft. gauge railway, 1½ mile in length, to the dam. Displacers for the wall are carried on flat trucks travelling on an inclined track at right angles to the line in the quarry, and delivered on to the railway at a lower level. No power is required for the operation of this incline, the full trucks running down hauling the empty trucks up to the quarry. There are two electrically-driven concrete mixers, each of 54 cubic feet capacity, the discharge from either of which can be directed, at will, either on to a bucket elevator for transfer to tracks commanded by a 10-ton cableway or on to a conveyor belt 32in. in width running on an elevated trestle-work parallel with the main wall, and just clear of it on the upstream side. Movable trippers run on rails laid on the trestle work, by means of which concrete can be discharged through chutes into any desired portion of the work. The first section of the belt and trestle work is about 500ft. in length. The trestle work consists of 50ft. trestles alternating with 17ft. towers, the material of which is Oregon pine, with the exception of the lower members of the trestles which are of steel, and any pieces subject to cross bending, which are of hardwood.

With the exception of a drag line excavator and a steam shovel, the whole of the plant at the dam site is electrically operated, direct current being generated at 480 volts by two sets of high-speed vertical engines, direct coupled to 300-kilowatt generators, steam being supplied by Babcock and Wilcox boilers fitted with chain grate stokers. A 10-ton electric cableway of the Lidgerwood type, with a span of 1290ft., commands the portion of the work being carried out by New South Wales. Three derrick cranes, electrically operated, and each of 5 tons capacity, are employed on the wall construction, placing displacers, moving forms, &c. These cranes are capable of lifting the full load of 5 tons at any radius between 10ft. and 50ft., at a speed of 40ft. per minute. For the transport of materials a road has been constructed to the dam site, a portion of an existing road being utilised for the purpose. Cement and stores are brought from Albury railway siding by eight motor lorries.

FIG. 9—PLACING CONCRETE IN CORE WALL OF HUME RESERVOIR DAM

TORRUMBARRY WEIR AND LOCK.

The Torrumbarry weir and lock, situated on the Murray some 20 miles by road downstream from Echuca, is another work carried out under the powers conferred by the River Murray Waters Acts—the constructing authority being the State of Victoria. The weir raises the summer level of the river by some 16ft., and thus substitutes continuous diversion for the intermittent diversion hitherto dependent on the varying level in the river, and, at the same time, provides for the passing of river craft, but without offering serious obstruction to the passage of floods. These objects have been achieved by the construction of a concrete foundation, combined with movable steel trestles which support stop bars to the height necessary to keep the river at diverting level. In times of flood, the drop bars, and, if necessary, the trestles themselves, are removed to the river bank.

This work will ensure a regular supply of water by gravitation throughout the year to the districts between Torrumbarry and Swan Hill, comprising over 150,000 acres—hitherto dependent on pumping plants during low stages of river flow—and to other districts containing about 100,000 acres, which previously received more or less irregular supplies, being served by gravitation works only, and will, in addition, enable large areas adjacent to these districts to be commanded by extensions of existing channel systems.

Various views of the weir and lock are given in Figs. 3, 4, 5, 7, and 8 on page 462.

GOULBURN WEIR (VICTORIA, AUSTRALIA).

The Goulburn weir is situated on the Goulburn River, a few miles above Murchison. It is built of concrete masonry, backed with coursed granite blocks. It is 695ft. in length over the abutments, exclusive of the space occupied by the channel regulators, together with a further 230ft., or 925ft. in all, and raises the summer level of the river about 45ft., to 408ft. above sea level, the height necessary to command the lands to be irrigated. The weir is provided with twenty-one flood gates of wrought and cast iron, each gate being 20ft. by 10ft., and weighing 7 tons. These gates are lowered into recesses in the body of the structure, during high stages of the river flow, to provide a clear waterway for the discharge of floods. The gates are raised and lowered by means of screw gearing operated by three turbines, the motive power being derived from the river water.

A view of the completed weir is given on page 462.

AUTOMATIC SIGNALS ON THE HARROW AND RICKMANSWORTH LINE

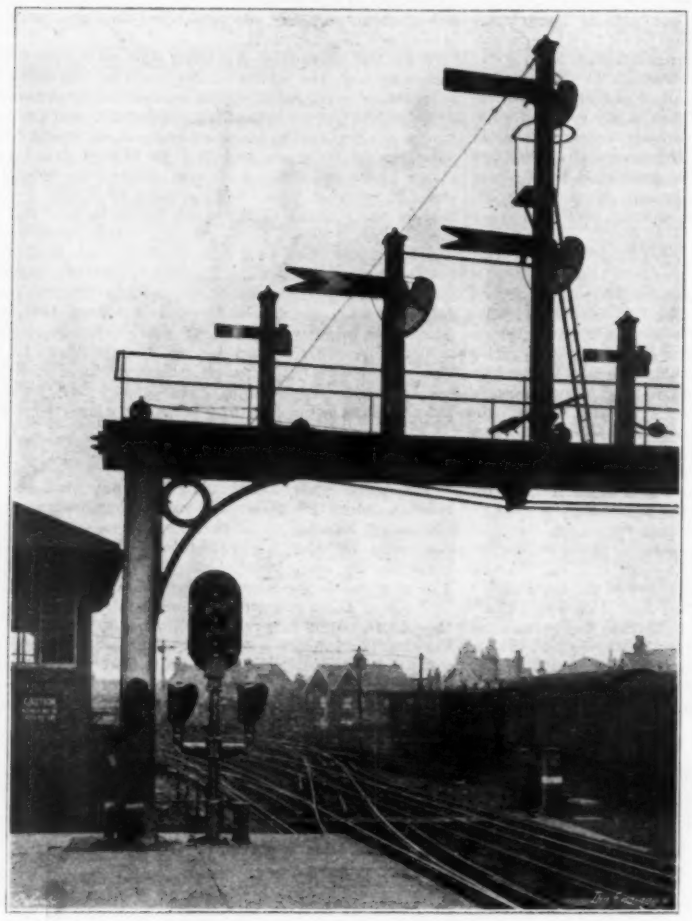


FIG. 1

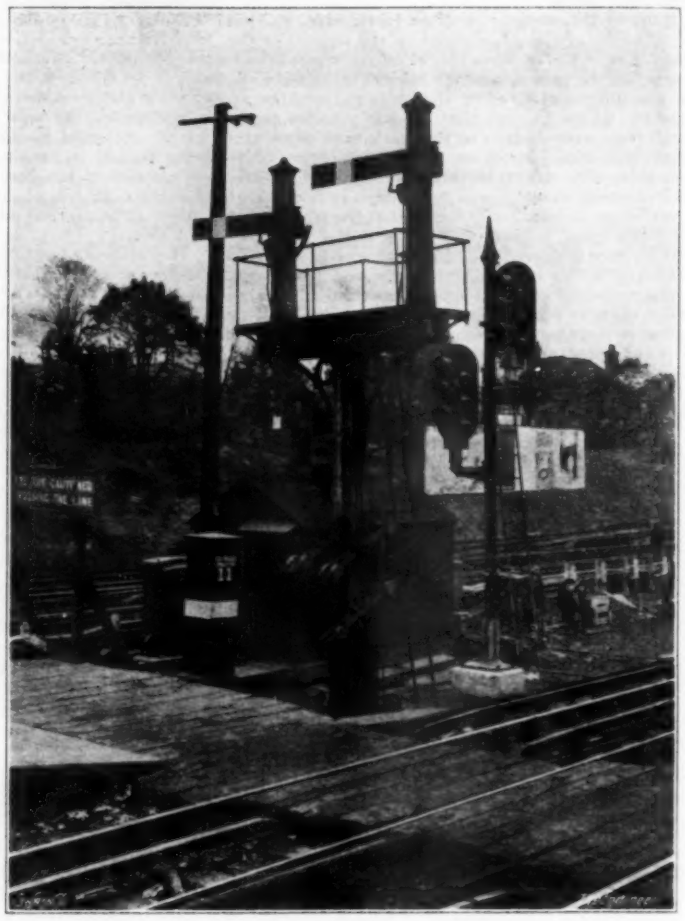


FIG. 2

Automatic Signalling on the Harrow and Rickmansworth Joint Line.

That portion of the Metropolitan Railway which lies between the point at which the Great Central section from Marylebone joins it, at Harrow South Junction, and Verney Junction, is leased to the Metropoltan and Great Central Joint Committee. The whole of the Metropolitan south of the Harrow South Junction has, for many years now, been protected by all-electric automatic or semi-automatic signalling. That protection—in connection with the extension of electrification to Rickmansworth and the building of the Watford branch, to be opened some time this year—has now been carried forward to Rickmansworth.

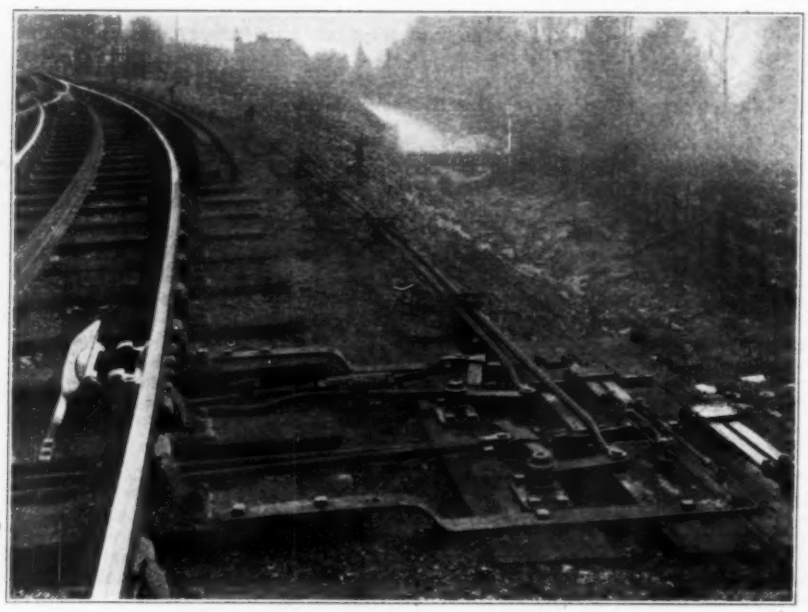


FIG. 3—MECHANICAL DETECTION OF DERAILERS

It may be explained that Harrow Station has been re-signalled. The four lines of way that became two on the north side of the station have been carried, as four lines, up to the North Junction, and the necessary engineering work is now in hand whereby the two lines on the down or south side will be the main lines to and from Rickmansworth and the North, and the two lines on the up or north side will be the Uxbridge branch down and up roads. The latter are being lowered, and the main lines will pass over them by a flying junction. The operations at this point have necessitated the construction of a new signal-box at Harrow North Junction, whilst Harrow Station box has been completely re-signalled.

All the signals, except those for shunting, between Harrow South Junction and Rickmansworth are of the day colour-light type. They give the three aspects—"danger" by a red light, "caution" by a yellow, and "clear" by a green—of a three-position signal and this arrangement dispenses with distant signals. The compactness of the light signal, as compared with semaphores, is seen in the two illustrations—Figs. 1 and 2. The four posts on the bridge of signals in Fig. 1 have been replaced by the light signals seen; the two smaller of the latter replace those with miniature arms on the bridge and have only red and yellow aspects. Fig. 2 shows the arrangement of light signals at a junction, and what is provided instead of the bracket semaphore post.

The light signals in Figs. 1 and 2 have, it may be noticed, a side light. It gives a motorman, who may be standing close up to his signal, a side view of the light that is illuminated—the red, the yellow or the green—in case he is out of the range of the beam of the front lights.

There are seven signal-boxes and one ground frame between the south end of Harrow Station and, but exclusive of, Rickmansworth. One of the economies of automatic signalling is that these boxes need only be opened when shunting or other movements have to be made. When such movements are necessary, the signalman goes into the box, and, if the illuminated diagram shows that no train is approaching, he puts the running signal levers to normal. That action causes the automatic signals which protect the proposed movement to go to "danger." The signal levers, being at normal, release the point levers, and the latter, when used, lock the signal levers. When the movement is completed and the point levers restored, the signal levers are again pulled over and the running signals resume their automatic working. The signals so controlled are known as semi-automatic. The control is electrical and is actuated by circuit breakers on the levers. One advantage is that all the levers, weights, slotting gear, &c., seen on the semaphores in Fig. 2 are dispensed with.

Between Sandy Lodge and Rickmansworth will be the junction for the Watford branch. It will be triangular, so as to give communication to and from Rickmansworth as well as to and from London. One signal-box will control the three junctions; that at the London end will be operated mechanically, and those in the Rickmansworth and Watford directions respectively, about 460 yards each from the box, will be actuated by power.

In The Engineer of May 27th, 1921, we pointed out the superiority of a derailer over a safety point, in that it gave a slightly longer length of siding. Derailers have been provided in four of the sidings at Rickmansworth. The Ministry of Transport requires the signals for passing out of or into connections protected by derailers to detect the latter. Two of the four at Rickmansworth are detected electrically and two mechanically. On the right in Fig. 3 is seen the mechanical detection of the latter, and on the left one of those two derailers off the rail.

The plans for the signalling thus briefly described were prepared by Mr. W. Challis, the late superintendent of signals and telegraphs, Metropolitan Railway, and the material was supplied and the whole of the new and altered work carried out by the Westinghouse Brake and Saxby Signal Company, Ltd., 82, York-road, King's Cross, N. 1.

Mineral Production of New South Wales.

His Majesty's Trade Commissioner at Sydney has forwarded to the Department of Overseas Trade a review of the mineral production of New South Wales for 1924, furnished by the Minister for Mines. It appears from this review that the value of the output of minerals in the State for the year was £18,623,088, which constituted a record, being £2,331,672 in excess of the value recorded for 1923, which previously was the best year. Almost every branch of the industry furnished augmented yields, the greatest

advance being the mining for silver-lead, coal, limestone products and tin coming next. The aggregate value of all the minerals won up to the end of 1924 is over £385,000,000. During the year the mining industry gave employment to 33,184 persons in and about the mines, or an increase of 488 as compared with 1923.

SILVER, LEAD AND ZINC.

The value of the output accruing to the State of silver, lead and zinc amounted to £5,606,931 for 1924 and represented a substantial increase of £1,238,417 as compared with the previous year. Treatment of the ores and concentrates is carried on in other States, and the value accruing to the Commonwealth of the products of the silver-lead mines of New South Wales is very much higher, viz., £7,765,032—exclusive of cadmium and copper, valued at over £73,000. At Broken Hill the quantity of ore raised amounted to over 1,050,000 tons, or an increase of over 170,000 tons as compared with 1923, and employment was found for an average of 5238 men, as compared with 4934 during the previous year. The Yerranderie field also experienced a successful year, 5417 tons of ore being won, and the output being valued at £108,022. The production for 1924 comprised silver-lead ore and concentrates, 240,957 tons, £4,297,748 ; zinc concentrates, 353,650 tons, £1,296,571 ; and silver (metal), 93,484 oz., £12,612. The aggregate value of silver, lead and zinc produced in the State to the end of 1924 is £116,767,433.

COAL AND COKE.

The quantity of coal won during 1924 was 11,618,216 tons, valued at the pit-mouth at £9,589,547, and was the largest production to date, being 1,139,703 tons in excess of 1923 and 824,829 tons greater than the previous record, viz., 10,793,387 tons in 1921. The total production of coal in the State to the end of 1924 is nearly 300,000,000 tons, valued at the pit-mouth at approximately £142,000,000. The coal mining industry afforded employment for 23,230 men, as compared with 22,989 during the previous year. Notwithstanding the serious industrial dispute during the first quarter of the year the output of metallurgical coke was well maintained, being 564,362 tons, valued at £932,926, or very little below the production for 1923.

TIN.

Tin mining was stimulated by the satisfactory price of the metal, which was not less than £200 per ton throughout the year, and an abundant water supply in the New England District, which enabled the dredgers to work continuously. The principal sources of stream tin, viz., Tinga and Emmaville Divisions, showed greatly augmented yields, viz., £87,741 and £73,107 respectively, as compared with £49,922 and £47,892 during 1923. The returns from the Ardlethan Division, the principal lode mining district, were also very satisfactory, being 375 tons of concentrates, valued at £50,650, the tonnage being double that for the previous year, viz., 173 tons, valued at £18,242. The production for 1924 was 1041 tons of metallic tin, valued at £259,485, as compared with 896 tons, valued at £180,789. The total value of the output of tin and tin ore to the end of 1924 is over £13,000,000.

COPPER.

The position with regard to copper mining remains unaltered, and until the metal greatly appreciates in value, or unless some process of extraction, other than direct smelting, which would largely reduce costs, be devised, no marked increase in production from the mines in this State can be looked for. The output for 1924 was 1129 tons, valued at £71,658, and, as in the previous year, a large percentage was won by recovering the copper content from Broken Hill silver-lead ores. The total output of copper to the end of 1924 exceeds £15,000,000.

IRONSTONE.

The production of pig iron from New South Wales ores was 74,075 tons, of an estimated value of £518,525, and was less than that for the previous year. The ore supplies of the largest smelting works are drawn from outside the State. The output of iron oxide, used for pigments and gas-purifying purposes, was 4863 tons, valued at £5361, and showed an increase of £2280 as compared with 1923.

LIMESTONE.

The manufacture of Portland cement continues steadily on the up grade, the output for the year being 272,300 tons, valued at £1,200,000, or an increase of 48,448 tons and £174,313 in value as compared with 1923. At least one other company will be producing in 1925, and, as two other companies are carrying out development and construction work, and preliminary investigations are being made by several other interests, the further rapid expansion of this section of the mining industry may be confidently anticipated. Lime to the value of £92,582, representing a slight increase, was also produced, but limestone flux was somewhat less than in 1923, and amounted to 114,756 tons, valued at £43,034.

GOLD.

The production of gold was 18,685 oz. fine, valued at £79,370, which is approximately the same as 1923. About one-half of the yield was won by dredgers, both the Adelong and the Gundagai Divisions, with outputs of £22,438 and £15,315 respectively, furnishing increases. The total value of the gold production of the State to the end of 1924 is over £63,000,000.

OTHER MINERALS.

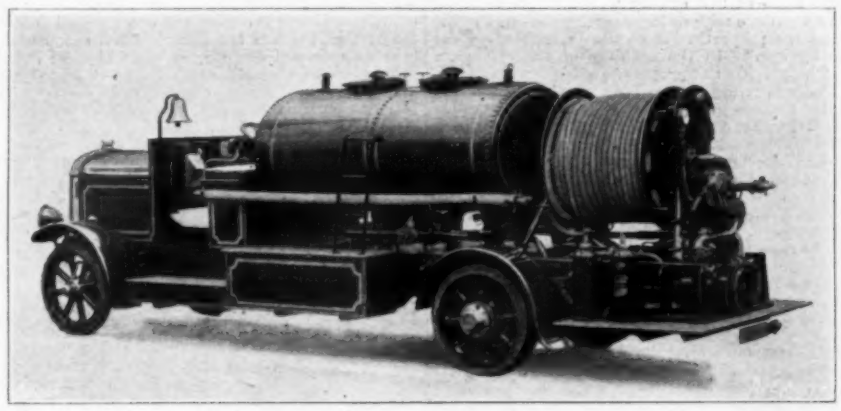
The value of the output of other minerals is as follows :—Alunite, £4032 ; arsenic, £18,850 ; bismuth, £3135 ; chrome, £2082 ; clays from areas held under mining lease, £26,530 ; diamonds, £498 ; dolomite, £12,559 ; magnesite, £12,772 ; manganese, £13,281 ; marble, £1410 ; molybdenite, £2475 ; precious opal, £10,500 ; platinum, £12,422 ; silica, £15,467 ; shale (oil), £962 ; slate, £535 ; wolfram, £170 ; and sundry minerals, £85,980.

Motor Foam Fire-Fighting Engine.

FOR some time past the London Fire Brigade authorities have been considering the added fire risks involved by the more general use of liquid fuel and the storage of petrol and other inflammable spirits, and have investigated the possibility of utilising a motor appliance carrying the necessary chemicals and pumping plant for projecting fire foam in large quantities. As a result, Tilling-Stevens Motors, Ltd., of 26, Victoria-street, Westminster, S.W. 1, were recently given an order for the appliance which is illustrated in the accompanying engraving. This type of machine was decided upon, so we are informed, after tests with appliances of various makes and after considering the various systems available.

The motor foam engine has been designed by Tilling-Stevens Motors, Ltd., in conjunction with Foamite Firefoam, Ltd., which has had extensive experience in large foam installations, large plants of a fixed nature having been installed in the storage depôts of the principle oil companies, while similar systems have been provided on many of the big ocean-going liners utilising liquid fuel.

The machine which Messrs. Tilling-Stevens have built consists of one of their well-known petrol electric chassis



MOTOR FOAM FIRE-FIGHTING ENGINE

with various modifications to suit the fire brigade requirements and to carry the weight involved in such a plant.

The tank, which is of steel, is of 600 gallons capacity, and of oval section. It is divided into two compartments holding the two chemical solutions, and is provided with large manhole covers with gun-metal air vents and indicator rods, which automatically show the level of liquid in the tanks. The two chemicals are led through valves and pipes to two rotary pumps, which are mounted at the rear of the chassis and driven through worm gear from an electric motor, which receives current from the dynamo of the petrol-electric transmission system. The two solutions are then passed to a hose reel, which carries a twin line of 1½in. special rubber hose, and then through a collecting breeching into a mixing tube about 4ft. from the nozzle. The nozzle has a shut-off valve and a jet ⅞in. in diameter. Each pump is fitted with a by-pass valve, so that should the controlling nozzle be shut off with the pumps at work each liquid by-passes from the delivery to the suction side of the pump until such time as the control valve is again opened. Mounted at the back of the machine is a starting switch for operating the pump motor, a voltmeter and ammeter and two pressure gauges, one for each pump.

The body work consists of side lockers for carrying small appliances and a driver's seat for accommodating two or three men, and, in addition, there is a back platform on which a further crew can be carried. Mounted on this back platform are four two-gallon Foamite extinguishers, which are useful for subduing small subsidiary fires after the main outbreak has been dealt with.

The machine in question is the first motor appliance to be put into service in this country purely for dealing with liquid fuel fires, and undoubtedly will be watched with much interest by fire brigade officers in other towns.

Special Railway Saloon for South Africa.

A SALOON of special design has been constructed at the Pretoria Railway workshops for the eventual use of the Governor-General. It was anticipated that it would be completed and ready for service about the middle of April, and it will be placed at the disposal of the Prince of Wales during his forthcoming tour of the Union of South Africa. The saloon is of the articulated type, having two separate bodies and underframes, and three bogies, the centre bogie constituting the articulation between the two coaches and supporting one end of each.

The order for the two underframes was placed with the Leeds Forge Company, England, but the rest of the work, as well as the erection, has been done in South Africa. In the following description of the vehicles it will be convenient for identification purposes to refer to the coaches as "A" and "B."

Designed in the Chief Mechanical Engineer's office, Pretoria, and constructed in the railway workshops, they will undoubtedly afford an excellent example of South African skill and workmanship. The total length over each body is 45ft., width 9ft. 3in., over dado boards at sides, which is 6in. wider than the standard main line coach ; the height from the floor to underside of ceiling in clerestory roof is 8ft. 3½in. The coaches will be divided up into various compartments. Coach "A" will comprise a stove room, a bathroom, 6ft. 5½in. by 6ft. 4½in.; three state rooms, 7ft. 1½in. by 6ft. 4½in.; and a large state room, 11ft. 1½in. by 6ft. 4½in. Coach "B" will contain a box room ; a bathroom, 7ft. 1½in. by 6ft. 4½in.; a bedroom, 10ft. 4½in. by 6ft. 4½in.; a study, 7ft. 1in. by 6ft. 4½in.; and a saloon, 14ft. 4½in. by 8ft. 4in.

The windows throughout are of the lazy tongs frameless type and the openings are provided with louvres covered with copper wire gauze as a protection against mosquitoes when travelling in the low veld. Inside the windows will be fitted with blinds or curtains. The body framings are constructed of teak, and all furnishings are of selected South African timbers, such as Rhodesian teak, West African mahogany, stinkwood and chemnen. The exterior will be finished in cream enamel paint, with the Royal coat of arms fixed to each side of each coach.

Coach "B" will be reserved for the use of the Prince of Wales and coach "A" for a portion of his staff. Commencing at the outer end of coach "B" there is the main saloon, and entrance may be gained on either side by means of movable steps, which can be hand operated and tucked away underneath the coach when not in use. The compartment forms a large and comfortable observation saloon, the end having windows and a central door with glass panels, so that an unobstructed view of the country will be obtainable when the coach is trailing. At each side, too, there are large windows. The artificial lighting is to be effected by a four-branch electrolier and six roof lights controlled by push switches. Ceiling fans, telephone and communication bells are among other fittings which complete the furnishing. The floor is covered with brown cork linoleum with carpets over it. Through a doorway at the end of the saloon the corridor is entered, and on the right is a study containing a knee-hole writing desk with a bookcase above it, while on the opposite side is a larger bookcase fitted with cupboards underneath. At one end of the study is a door communicating with the bedroom, which contains a large naval type berth with drawers underneath, a three-piece wardrobe, and a dressing table. A bathroom adjoins the bedroom. The compartment known as the box room, situated at the articulation end next to the bathroom, will be partly used for accommodating a valet, and for that purpose it will embody a folding berth.

Coach "A" is entered through a vestibule arranged between the two coaches over the articulation. The large state room and the three smaller state rooms are placed next to each other and may be entered through doorways leading off the corridor. Each room is furnished with bunks, folding wash basins provided with hot and cold water cocks, and wardrobes. The lighting is furnished by electroliers, bracket lights, and berth lights, while ceiling fans are arranged in the roof of each compartment. The bathroom for the use of the occupants of this coach is finished and fitted up on lines somewhat similar to the bathroom in coach "B." At the outer end and next to the bathroom in coach "A" is a stove room containing a "Duplex" boiler which supplies hot water to both coaches. A large supply of water will be carried in tanks fixed to the underframes, from which it will be pumped by means of rotary hand pumps to the overhead tanks in the roof. The saloons will be steam-heated in cold weather by means of radiators in each compartment.

The Gleno Dam Failure.

THE findings of the official committee of inquiry into the Gleno dam disaster were summarised in THE ENGINEER of December 12th, 1924, and in the issue of March 20th, 1925, consideration was given to the conclusions of a committee appointed by the owners of the dam, the "defence committee" as it has been called. While it is established that the design was barely adequate, theoretically, and did not practically provide reasonable margins of safety, it is not one which would under any circumstances be regarded as a starting point for the design of a dam of the same general type, while the dominating causes of the failure were in the domains of administration and supervision. Since, however, some British engineers may wish to be able to refer to a fairly full presentment of the whole affair, including a criticism of the design, with calculations of stability and stresses applied to different parts of the dam, it may be pointed out that such a study is furnished in three issues of *La Huille Blanche*, March–April, September–October, and November–December, 1924, the articles being from the pen of M. J. Boudet, a member of the French Society of Civil Engineers and of the Associazione Elletrotecnica Italiana.

This independent study fully supports the findings of

the official committee. M. Boudet describes the nature and geological features of the gorge very fully, and concludes that leakage occurred through the concrete and masonry, and was most pronounced at the junction of the dam with the sides of the gorge. No cause referable to geological or seismological conditions can directly or indirectly have occasioned the failure of the work, but an examination of the plan of the site as it was before work was begun shows that it would have been better to place the whole work some 20 m. or 25 m. further upstream. The final design, though not beyond criticism as regards stability, is not abnormal, either in its conception or in its general dimensions. There was, however, insufficient notching or stepping of the rock for the foundations of the piers, some of which were inclined downstream. These considerations are overshadowed by the very much more serious defects of the work in other respects. Examination of the dam after the collapse fully supports the evidence of witnesses as to the employment of unsuitable and badly assorted materials: "Large, unbonded stones, lumps of hardened cement or lime without sand," and so forth. The concrete was very poorly compacted. Tests of four specimens, carried out at the Milan Polytechnic, gave rupturing stresses of 45 kilos., 50 kilos., 70 kilos. and 105 kilos. per square centimetre.

M. Boudet asserts that during the execution of the work supervision was almost non-existent. Sands and gravels were taken from alluvial deposits and were often used unwashed. Lime of bad quality was employed. Much of the work was done with reckless negligence, one witness stating that the proportioning of the concrete was done "entirely by eye." In the building of the cyclopean masonry, whole trucks ("wagonets") of earth were added. After the failure, reinforcement rods were found in some cases to be without adhering mortar for considerable lengths, and showing no signs of having been bonded with the mortar. There were segregations of mortar without stone, and of stone without mortar; there were many voids, and pieces of scaffolding and forms were embedded in the masonry.

Conventional calculations of the stability of the arches, and of the stresses, give fairly satisfactory results, but a close examination, using Möhr's circle, discloses the existence of a tensile stress of 2 kilos. per square centimetre. By means of a number of diagrams, M. Boudet presents his calculations of shearing stress and traces the probable series of strains and shifts leading up to the collapse. He attaches some importance to the alteration of stresses due to the rising water level during the flood, which he regards as having provided the final touch which destroyed the dam. He considers that the report of the committee appointed by the owners throws no further light on the affair as previously investigated and reported upon. He is not impressed by the explosion theory.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

THE FUTURE OF THE MARINE ENGINE.

Sir,—The Diesel motor for ships "is being developed and applied with enthusiasm and vigour by foreign competitors," and their successes are detailed here with no less enthusiasm; but is it wise to ignore the fact that those competitors have been forced, since not all can live on the manufacture of the Diesel, to improve the steam engine to such extent that it has now been made, as the figures below prove, almost as efficient thermodynamically as the Diesel?

The progress here made with steam is already sufficiently great as to indicate that in the near future the oil engine will be equalled in economy, on the B.Th.U. basis, by the high-pressure piston engine burning poor coal.

From "De Ingenieur," The Hague, August 9th, 1924.

Engine power, I.H.P.	112 ..	99
Steam pressure, lb. per sq. in...	220 ..	446
Steam temperature, deg. Cent.	490 ..	584
Steam consumption, per I.H.P. hour, lb.	6.5 ..	5.65
Consumption, low-grade coal, including all auxiliaries, lb.	1.25 ..	1.1
C. heat units per H.P. hour ..	2450 ..	2186
Best Diesel motor record ..	— ..	2000

Small sizes do not show the best economy. Much improvement is to be expected in larger units. These engines are straight compounds, with Davy-Paxman-Lentz valve gear, and "double compounds," of the same type—950 horse-power—are fitted to ss. Bilbao, with Klug reversing gear. The indicator cards are very much like those from modern compound locomotives, but with a very steep drop of pressure in the high-pressure cylinder, owing to the exceptionally large size of the low-pressure cylinder, in which about 2 atmosphere initial pressure balances the load on the high-pressure with 15 atmospheres initial pressure.

Compare this simple, straightforward equipment with that outlined by Sir John Biles at the Institution of Naval Architects as a possible means of realising the shaft horse-power on 6.9 lb. steam, triple-expansion turbines, 500 lb. pressure, 700 deg. Fah. temperature, oil-fired water-tube boilers, waste gas air preheaters, exhaust and bleeder steam feed-water heaters, and the screws driven by a combination of double and single reduction gearing.

It has long been generally admitted that the piston steam engine is more economical than the turbine. The extreme complexity of the triple-expansion turbine with its gearings and large plant of auxiliaries calculated to enable it to equal the Diesel in efficiency may be a handicap on a solution, so much more easily reached in compound engines.

These figures show the greater fuel economy realised by increasing the pressure from 220 lb. to 446 lb. per square inch, and the coal rate as given brings us back fifty years, when Loftus Perkins, with 400 lb. to 500 lb. pressure, claimed that, compound condensing, he obtained an effective horse-power hour for 1 lb. of coal, or 1.63 lb. in single expansion, with his well-known marine engines. These engines worked, as they work still to-day, without any lubrication, through the use of the Jacob-Perkins "no-oil" piston rings and glands.

The economy of 1 lb. coal per effective H.P. hour at 400-500 lb. pressure with Loftus Perkins' "no-oil" compound marine engines is nearly confirmed in the statement by Mr. R. J. Walker, Institute of Naval Architects: "With boilers of 500 lb. pressure, the figure could be reduced to 1.0 lb. per shaft horse-power." Sir Charles Parsons incidentally mentioned the highest pressure of 1250 lb. in a stationary plant of the United States.

Nearer home, in 1827, ninety-eight years ago, numerous notices appeared in English, German, French and American technical journals to the effect that John Penn and Son, marine engineers and Government contractors, Greenwich, were equipping a steamship with Perkins' double, or twin, uniflow engines, designed to develop the specified power at 6 per cent. cut-off with a pressure of 2000 lb. per square inch. The steam drums were then drawn from a single bloom by Messrs. James Russell and Co., of Wednesbury—and now of Walsall also—and were tested to 20,000 lb. per square inch, or over six times the maximum working pressure (3000 lb.) contemplated in 1827. After superheating to about 1000 deg., the steam was re-saturated in the drums, with improved results. Marine engineers have not forgotten the Wethered process of re-saturation, which was stated to give 20 to 40 per cent. economy over superheated steam on several ships. This matter was revived during the discussion on the paper on "Superheating," at Birmingham (1859) by the President of the M.I.M.E., Mr. John Penn, the same Penn (junior) who used to confer with Jacob Perkins on the question of his super-steam. After about twenty years' marine practice superheating was finally abandoned—"It is now on the decline," John Bourne, 1869. High pressures may yet supersede superheating, for change in steam engineering is ceaseless. "Perhaps there is a fashion in engines," Sir John Biles. Fashions in steam pressures, in superheating and in engines are periodic, and neither turbine nor Diesel engine may be exempt from supersession. The compound system has played shuttle over since its first introduction, and was but recently strongly condemned by writers who are now reintroducing it in connection with uniflow engines. In 1842 we read of its "revival" by G. and J. Rennie, with results surprising at that time. If British "eggs are in one basket" more than another, that basket, as shown by Lloyd's latest tonnages, is certainly the piston engine.

April 20th. Charles R. King.

GOOCH'S CŒUR DE LION.

Sir,—In your issue of 17th inst., on page 424, interesting details are given of Mr. D. Gooch's 4–4–0 broad-gauge locomotives, built in 1855. Amongst some old photographs I came across the enclosed, a photograph of the Cœur de Lion, which, I believe, was one of the ten locomotives mentioned. The erection at the rear of the tender is apparently a guard's seat.

H. V. Pegg.

Rhyl, North Wales, April 20th.

GOOCH'S LOCOMOTIVE CŒUR DE LION

CANNEL COAL.

Sir,—The extract in your current number from your issue of sixty years ago, which refers to the possible origin of the term "cannel coal," interested, but did not convince me. The highest authority—Sir James Murray in the "Oxford English Dictionary"—confesses to some doubt as to the etymology of cannel, thus: "Of northern, probably Lancashire, origin. *Can'le, cannle* is the Scotch and northern form of *candle*, and the opinion has been expressed, at least since early in the 18th century that *cannel-coal* is really = '*candle-coal*.' It does not appear in evidence that the pronunciation of *candle* as *can'le* goes back in Lancashire to the 16th century, though such may be the case. A greater difficulty is that it is doubtful whether the original name was not simply *canel*, rather than *cannel* coal: see the first mention in Leland, 1538. But no other etymological conjecture yet offered will bear examination."

The first eighteenth century quotation as to etymology is found about 1734 in North's "Lives," I., 294: "Famous for yielding the *Canal* (or *Candle*) coal. It is so termed, as I guess, because the manufacturers in that country use no candle, but work by the light of their coal fire."

Whatever the ultimate origin may be, I think the date of the following quotation, the first known reference in literature, rules out the attempt to associate the word with canal or kennel-borne coal.

1538 Leland, Itin. VII., 47. "Mr. Bradeshau hath a place caullid Hawe a myle from Wigan. He hath founde moche canel like Se Coole in his grounde very profitable to hym."

London, April 21st. H. F. R.

THE CONTRA-PROPELLER.

Sir,—The interesting article in The Engineer for April 17th on "Increasing the Efficiency of the Screw Propeller" causes one to wonder why the method has not been used before. No one would design a turbine or centrifugal pump without providing fixed guide blades; yet the principle of the screw propeller is exactly the same. Is there some practical objection which is not touched on in the article?

One obvious point is that the contra-propeller must decrease efficiency in reverse; probably this would not be enough to affect the manœuvring power of the vessel to any serious extent, but it would be instructive to obtain definite information on the point. For forward motion the theoretical advantage seems obvious, and the problem becomes simply one of overcoming practical difficulties, as the author of the article states has been done.

L. H. G. Dines.

Teddington, April 18th.

THE THEORY OF ROAD CONSTRUCTION.

Sir,—It is difficult to avoid the conclusion that a good deal of research work in laboratories is thought to be necessary when it is not really needed; the persons who are entrusted with the carrying out of the works being out of touch with, or mistrustful of, those experienced engineers and professors of engineering who could in many cases give in a short report information the same as that which, after a long delay, they receive from the laboratory investigators.

This consideration applies especially in the field of civil engineering, and perhaps more particularly in regard to roads. A number of almost startling examples are furnished in a report of the Highway Research Board of the United States, and in an article by Mr. A. J. Goldbeck, an officer of the Bureau of Roads, both published in a recent issue of the official journal, *Public Roads*. In the report it is claimed by an engineer of the United States Bureau of Roads that over 9,000,000 dollars have been saved by "the use of the thickened edge in the design of concrete roads—which is the result of an extended research. . . ." Yet this method of making the edge of a road crust as effective in supporting wheels as are other parts of the crust has been familiar to road engineers for more than twelve years, as has another method, that of extending the crust beyond the incidence of wheel loads, the value of which the present writer strongly urged in a paper read before the second Irish Road Congress in 1912. As applied to the crust of a water-bound broken stone road, one can understand the matter having been overlooked, but as applied to a concrete slab, it should have been self-evident from the first, on the most elementary theory of the stresses in slabs. Yet Mr. Goldbeck also in his article gives it as the result of research that: "In slabs of uniform thickness the highest longitudinal stresses exist along the edge and along the centre joint. They occur with wheels running directly over the edge of the slab and along the centre joint." He also states that: "A concrete slab should have a thickened edge in order to receive uniformly distributed maximum stress under traffic. This conclusion bears out the conclusions which have been reached as a result of the Pittsburg test road and the Bates test road." It may also be pointed out that it is supported by the conclusions arrived at by almost every boy who has made cardboard models, and by the experience of the makers of castings for engine beds.

Mr. Goldbeck also gives to research the credit for our knowledge of other facts which were already widely known and could, in any case, have been deduced from theory and experience. He states that: "Reinforcing steel placed longitudinally and transversely in equal percentages is more effective in preventing corner failures than the same amount placed in one direction," and that when "the presence of the steel did not assist greatly in preventing the formation of the first crack, it did prevent the development of the crack and the further failure of the slab." As regards the concrete used for road slabs, one would not suppose that research was needed to establish the fact that "excessive wear will result from the use of a very soft stone as aggregate," or that "either an excessively dry or an excessively wet mix will show less resistance to wear than concrete of medium consistency."

I ought, in fairness, to add that both the report and the article from which these "hulls" of research have been plucked—for the fruit was gathered long since—do in parts usefully present quite interesting results of research.

April 20th. Reginald Ryves.

DILATOMETERS.

Sir,—In an article on "Dilatometers" in "The Metallurgist" accompanying The Engineer for March 27th, the title of one of the illustrations is "Griffiths' Dilatometer." I should like to point out that this is hardly accurate, and to emphasise what has been indicated in the text, that the instrument illustrated is essentially that devised by Messrs. Andrew, Rippon, Miller and Wragg, and described by them before the Iron and Steel Institute in 1920. My own contribution has been to modify their dilatometer so as to make it autographic and to facilitate its use. I should be glad if you could arrange to give publicity to the above facts, as I feel that the title as it stands is misleading.

Woolwich, S.E. 18, April 21st. W. T. Griffiths.

THE EFFICIENCY OF AIR COMPRESSORS.

Sir,—*Re* your correspondent "Interested's" letter, the tests he refers to were not ours, and we have no information, but if your correspondent wishes to suggest that a single-stage compressor is or can be more efficient thermally than a two-stage compressor, the high efficiency of which has been abundantly proved, we can only say that it is contrary to all engineering experience.

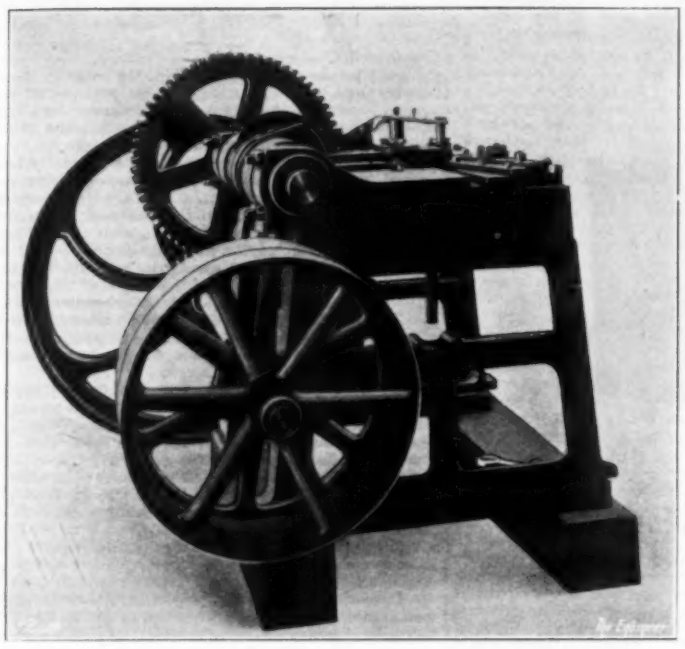
For Belliss and Morcom, Ltd.,
Albert Chas. Pain.

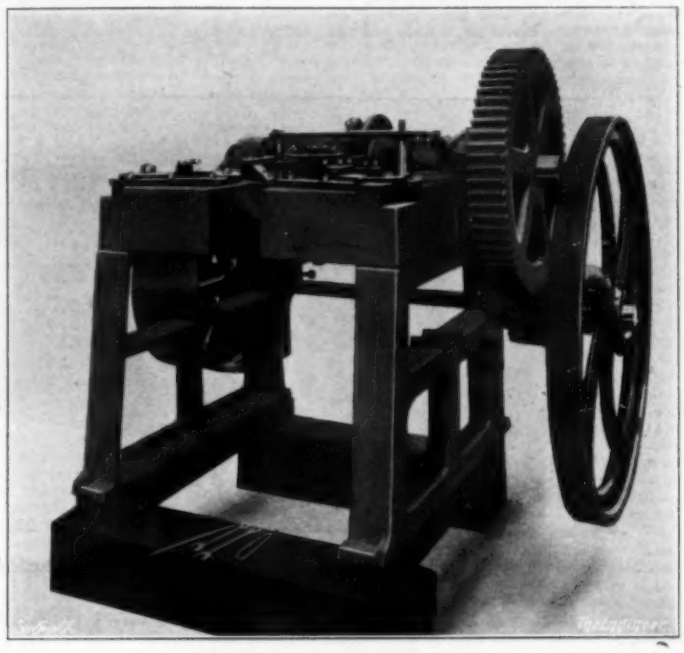
Birmingham, April 22nd.

The "John Wilkinson" Medal.—The "John Wilkinson" Medal will be awarded for the year 1924 5 upon the result of an examination which is open to all members of the Junior Section of the Lancashire Branch of the Institute of British Foundrymen. The examination will be held at the College of Technology, Sackville-street, Manchester, on Saturday, May 2nd, 1925, from 7.30 p.m. to 9 p.m. There will be no entrance fee. Entry forms should be sent to Mr. Makemson, Secretary of the Lancashire Branch, 21, Beresford-road, Stretford, Manchester, and should reach him not later than Thursday, April 30th, 1925.

MACHINE FOR MAKING CHAIN LINKS

WILLIAM GRICE AND SONS, LIMITED, BIRMINGHAM, ENGINEERS





A Chain Link Making Machine.

A SIMPLE, yet effective, machine for forming the links of ordinary chains, which has just been made by Wm. Grice and Sons, Limited, of Fazeley-street, Birmingham, is illustrated by the engravings above.

The machine is automatic in action, except that the rod, from which the links are made, is fed in by hand, and turns out links ready for welding at the rate of about twenty-two per minute. There are only three operations in making a link and they are all effected by the cam shaft seen running across the back of the machine. The bar is pushed through a die up against a stop, which can be adjusted to suit the size of link being made, and it is then sheared off by the movement of the die. A ram carrying a mandrel moves forward and, pressing on the centre of the cut length of rod, bends it into the form of a U. While the mandrel is still in place two tools working in diagonal slides force the limbs of the U round to complete the shaping. These two tools work at slightly different angles, so that the ends of the link are in different planes and they can consequently be threaded together. The mandrel is then withdrawn and a striker ejects the finished link.

When it is intended to weld the chain by hand at a smith's hearth the ends of the link are cut on the slant to make a scarfed joint, but for electrical welding a square joint is used, and it is made on the side instead of the end of the link. The machine illustrated is capable of dealing with bar stock up to ⅝in. in diameter.

The Classification of Spanish Railways.

IN an article appearing in the *Revista de Obras Publicas* of April 1st, it is remarked that little attention is being given to the subject of the reorganisation of long-distance communications in Spain, in its two aspects, the perfecting of existing lines, and the provision of the additional lines required in order to provide straightforward routes, so reducing the high costs of transport consequent upon the sending of goods by circuitous routes or resulting from transportage by road.

This matter was the subject of a "decree-law" of July, 1924, entrusting to the Superior Council of Railways the preparation of a scheme of classification into National, Regional, and Local lines, according to the character of each line, as shown by the nature of its traffic. The Council has accordingly formulated a preliminary scheme ("*anteproyecto*"), and in the *Gaceta* of March 13th last its proposals were made public, a term of two months being allowed for the submission of observations by official bodies concerned. After submission to the General Staff and to the Public Works Department, the scheme will be returned to the Council for the preparation of a definite plan and the formulating of rules for its periodic revision. The scheme provides that the State shall undertake the construction of the railways, as a whole or in part, and that any public body or private concern shall have the right to ask for preference in regard to the building of any particular line, subject to the public advantage.

The information tabulated by the Council includes lists of existing and projected lines, in both cases divided into the three groups. The total of the existing lines dealt with is 9142 kiloms. Of these, twenty-three lines, of a total length of 3176 kiloms., are classed as National, with an average length of 138 kiloms. The longest are:—Zamora to Santiago, and its branches, 403 kiloms.; Baeza to Requena, 310 kiloms.; Lérida to Jeruel, 273 kiloms.; Madrid to Burgos, 250 kiloms.; and Baza to La Encina, 235 kiloms. Of the thirty-nine lines classed as Regional, totalling 4089 kiloms., an average of nearly 105 kiloms., the longest are:—Torre del Mar to Zurgena, 310 kiloms.; Cáceres to Ciudad Real, 250 kiloms.; Málaga to San Fernando, the coastal line, 236 kiloms.; and Marine to Ribadeo, 226 kiloms. Thirty-eight lines are classed as Local, the average length being 38 kiloms., the total 1877 kiloms. Four of these lines are more than 100 kiloms. in length:—Badajoz to Fregenal, 123 kiloms.; Coruña to Corcubión, 115 kiloms. Media del Campo to Benavente, 115 kiloms.; and a line connecting Puebla de Sanabria with the Medina de Rioseco and Palanquino line, 102 kiloms. Eight of these lines are of less than 16 kiloms. in length.

There are also 1374 kiloms. of National lines under construction, including that from Gijón to Ferrol, 321 kiloms.; Ontaneda to Calatayud, 424 kiloms.; Lérida to Saint-Girons, 175 kiloms.; and Alcañiz to San Carlos de la Rápita, 150 kiloms. Five lines classed as Regional are also under construction, totalling 333 kiloms.

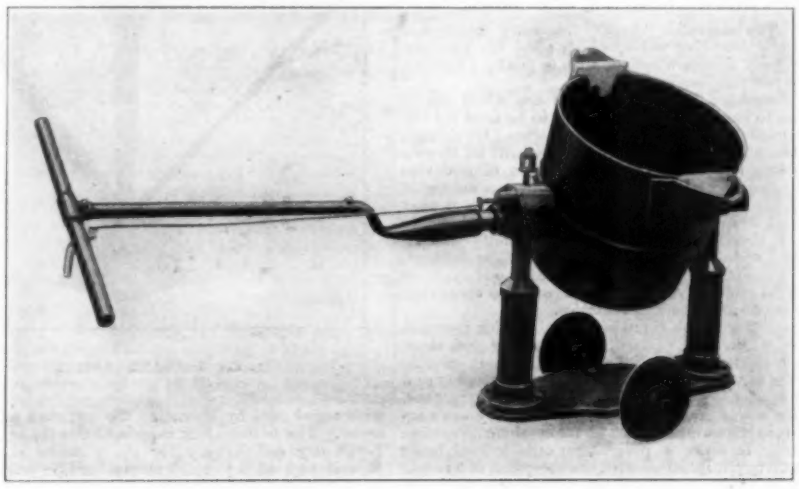
The total of 9142 kiloms., the existing lines referred to, accounts for more than half the mileage, some 10,000, of Spanish railways. Of the remainder, the Northern of Spain, belonging to a Franco-Spanish company, accounts for 3692 kiloms. The Great Southern of Spain and the Zafra-Huelva lines, both British, for 168 kiloms. and 183 kiloms. respectively; the West Galician, 75 kiloms., Gandia-Alcoy, 53 kiloms., and Bilbao mines railway, all British, may also be noted.

A Handy Foundry Ladle.

IN a foundry where any considerable amount of repetition work has to be cast, one of the difficulties is to pour all the moulds uniformly from a ladle in which the level of the molten metal is steadily falling. If the ladle is small enough to be man-handled the difficulty is readily overcome by the men, while with large ladles hung from a crane the attendants can regulate the flow to a nicety; but in the case of ladles run about the foundry floor on trolleys the problem is complicated. When the ladle is full only a small tilt is necessary to discharge the metal, and it falls into the gate of the mould at an uncomfortably high speed. Later on, during the process of pouring a large batch of similar castings, the lip of the ladle may come so low, before the metal will run out, that the gate cannot be commanded, and the ladle must be refilled before it is empty.

The difficulty has been overcome in a very simple manner, by the Constructional Engineering Company, Limited, of Titan Works, Charles Henry-street, Birmingham, in the ladle illustrated below.

The trunnions on which the ladle is rocked are mounted on the top of columns which are supported by strong coiled springs, so proportioned that the ladle rises as the weight is reduced, and keeps the level of the molten metal approximately constant throughout the length of the pour. The ladle, it will be seen, has two lips, and each of them is provided with a refractory skimmer to prevent slag being poured into the mould. The tilting handle is fitted with a safety catch to hold the ladle in a vertical position while it is being moved about the foundry, and the wheels have ball bearings, so that the caster can easily work single-handed.



FOUNDRY LADLE

These ladles are made in sizes for from 6 cwt. to 12 cwt. of metal.

IN the course of an article on bridge building, the *Engineering News-Record* says that considerable trouble was experienced in getting the long 1in. and 1¼in. rivets to fill the holes satisfactorily. Tapered rivets were used from the beginning, with a view to good upsetting, but this expedient was evidently not sufficient. While the rivets would test tight under the hammer, when cut out they would be found to be as much as 0.04in. less in diameter than the holes, bearing only under the two heads. After considerable experimenting, excellent rivets resulted by (1) uniform, clean heating, obtained by using a mixture of coke and coal in an oversize forge, fed with 40 lb. blast from the air line; (2) use of heavier plungers in the riveting hammers; (3) slightly quenching the ends of the rivets before driving, to ensure initial upsetting inside the holes; (4) making the taper as long as possible and the diameters such that the shop head would stand a slight distance from the metal when the hot rivet was inserted—in other words, making the rivets to fit the holes as tightly as practicable before driving—and (5) countersinking the holes $^{1}/_{32}$in. to $^{1}/_{16}$in. on the driving side to assist the riveter in driving the rivet stock squarely into the hole.

An Efficient Wireless Receiver.

MUCH has been written of late about the supersonic hetrodyne system of wireless reception, as employed very largely in America, and the following description of a seven-valve frame aerial set, working on this principle and are said to result in high quality reproduction. Moreover, the frequency conv rsion system gives rise to very simple operation, for all the circuits can be tuned by two condensers. The special design of the set on the lines described and the use of a frame aerial also result in a high degree of selectivity. Freedom from interference is accentuated by earthing the centre point of the aerial, so as to produce a strong directional effect. Moreover, the

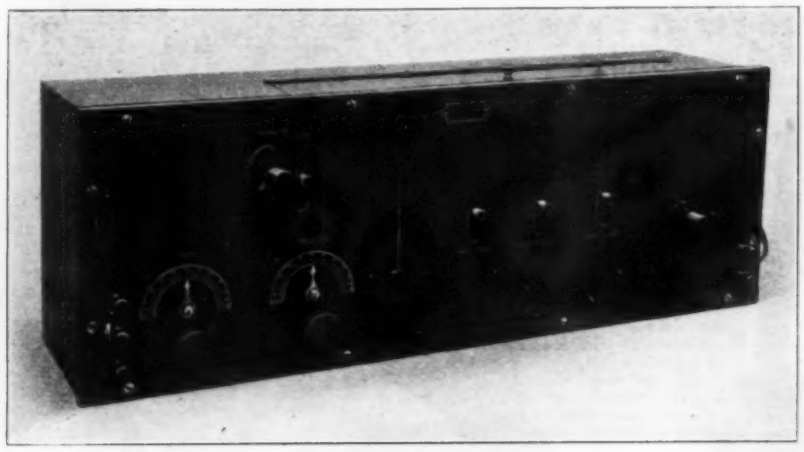


FIG. 1—SEVEN-VALVE SUPERSONIC WIRELESS RECEIVER

supplied by the Western Electric Company, of Connaught House, Aldwych, W.C., may be of interest. The set has been designed for the reception of British and continental telephony over long distances, and for a wave length range of from 300 to 3000 metres. It works with the well-known dull emitter "Wecovalves," and there are only two controls.

There is a local oscillation system and frequency converter, three stages of intermediate or "beat" frequency amplification, and a detector and low-frequency amplying stage. When using the three "beat" frequency stages, two of which can be cut in and out of action by the switches, to be seen in Fig. 1, the limitations to range, the makers claim, are only those imposed by atmospheric and other interferences. The incoming signals are received on the frame aerial shown in Fig. 3, and are hetrodyned by an oscillatory circuit producing after detection a resultant beat frequency of approximately 50,000 cycles. This retains the modulation of the original signal, and it is passed on to the three stages of amplification already mentioned. In connection with these stages, partially tuned anode circuits are used, and they are claimed to give a degree of selectivity which increases with the number of stages. The amplified "beat" frequency signals are detected by a detecting valve, which gives the required audio frequency signal, which in turn is finally amplified by the last low-frequency valve.

The "Wecovalve" valve filaments are wired up in series, so as to enable a single rheostat to be used for the control of the filament current to all the valves. Obviously, if one of the filaments fails all the valves will be thrown out of action, but owing to the provision of a device which indicates which valve has failed, this is a matter of no importance. Another feature worthy of note is that the potential drop across the valve filaments is used to provide the necessary grid bias. To prevent "back" coupling and instability, each stage in the set is shielded, and a small condenser neutralises the grid anode capacity of the first detector valve. Condensers are also connected across the anode and filament batteries.

In the oscillator circuit there is a switch, which provides a strong or weak local voltage, whilst a long and short wave switch on the frame aerial renders the frame suitable for the range of wave lengths mentioned. The tuning and oscillating condensers are of the maker's die cast pattern, designed for a wide range of capacity, and they are controlled through gearing, so as to make them give fine adjustments. In order to prevent an outside field being set up, which might interfere with the reception of a neighbouring set working on wave lengths similar to that of the oscillator, the latter is shielded. A view of the interior of the set is given in Fig. 2. The absence of reaction and the precautions that are taken to prevent "back coupling" set is very sensitive and stable, whilst the use of "Wecovalves" makes it very economical. Changes in volume are easily made by operating the three switches to be seen at the front of the cabinet, and wave length ranges are made

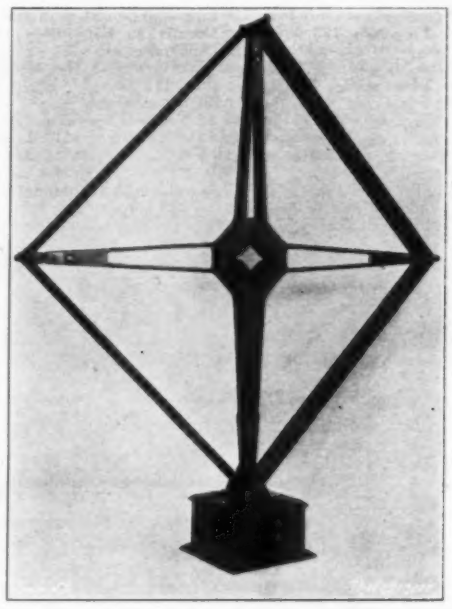


FIG. 3—FRAME AERIAL

with equal ease by operating the switches on the frame aerial. The battery box supplied with the set contains a 9-volt dry cell battery for the filament circuit and a 45-volt tapped dry cell battery for the anode circuits. The standard filament battery supplied with the set will serve for 75 hours, but by connecting another 9-volt battery in parallel with it, the working period can be increased to 300 hours.

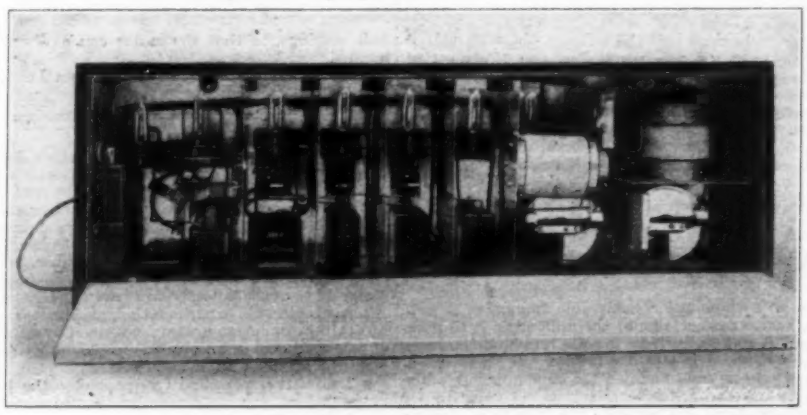


FIG. 2—INTERIOR OF SEVEN-VALVE SUPERSONIC WIRELESS RECEIVER

A New Tank Gauge.

A FORM of gauge for measuring the depth of liquid content in tanks, which employs a well-known principle, but is novel in its details, is being manufactured by Messrs. Negretti and Zambra, of 38, Holborn-viaduct, London, E.C. 1.

The principle adopted is that of balancing the hydrostatic head produced by the liquid in the tank by means of air pressure, and measuring the air pressure at any convenient station, which may, within reason, be a considerable distance from the tank, as the pressure of the air can be transmitted through small bore piping.

Up to the present the air pressure has generally been measured by means of a U tube, or manometer, but this arrangement suffers from the disadvantage that there are only two convenient working fluids, water and mercury. If a water gauge is used in connection with a water tank its height must obviously be as great as the depth of the tank, which may be inconveniently large. On the other hand, if a mercury gauge is used the height of the column may be so greatly reduced that accurate reading is difficult. There are, of course, other liquids, which might be used in the gauge on account of their high specific gravity, such as bromine and sulphuric acid, but they could hardly be recommended for everyday service.

Messrs. Negretti and Zambra have overcome the difficulty by using a dial gauge for measuring the air pressure; but have been successful only after much experimenting, as the differences of pressure which have to be indicated are naturally of a low order. The gauge which they have evolved operates somewhat after the manner of an aneroid barometer, that is to say, it is of the diaphragm type, and it is made with such care that the makers are able to guarantee its readings to be accurate within 0.25 per cent. The dial is 8in. in diameter, and the pointer travels over an area from 18in. to 20in. long, so that a good open scale is provided. Consequently if the apparatus is used in connection with a water tank, say, 18ft. deep, the depth of water can quite comfortably be read to within 1in.

The hydrostatic pressure in the tank is communicated to the air by means of a small diving bell fixed in the bottom of the tank. The open end of a plain pipe would, of course, also serve the purpose, but the diving bell has the advantage that it provides a much larger surface area, and faint leaks from the system consequently do not affect the readings materially. The bottom edge of the diving bell is formed by a notch exactly 1in. above the floor of the tank. When the gauge is used in tanks containing heavy viscous liquids it is usual to make the connection with the diving bell by means of a length of 1in. piping up to above the surface level, in order to eliminate any liability to temporary blockage. The connection is then continued with small bore soft copper tube, with metal-to-metal union joints where necessary.

A simple hand pump is provided for producing the air pressure, and is mounted close to the dial gauge. Directly beneath the gauge there is a three-way cock, to which the connections are run. When it is desired to take the depth of liquid in the tank the cock is turned to "tank" and the pump given a few strokes. The air then displaces the liquid out of the diving bell until it bubbles under the notch, when its pressure must equal the hydrostatic head. The cock is then turned to "gauge" and the indication read. The reading may, of course, be either feet of depth or weight of content in the tank, according to the calibration of the gauge. In this condition the gauge will continue to give a fairly accurate indication of the quantity of liquid in the tank; but as it is almost impossible to prevent some loss of air from the system, it is best always to give one or two strokes with the pump before taking a reading.

The third position of the cock is open to atmosphere, so that the gauge can be set to zero, or rather 1in.—the height of the notch in the diving bell.

Besides possessing the advantages already mentioned this gauge has the merit that it is unaffected by movement, such as the rolling of a ship, while the instrument can be readily adapted to give a continuous record or chart.

THE JUNIOR INSTITUTION OF ENGINEERS.

ON Friday, April 17th, Mr. Walter T. Dunn, M.I. Mech. E., read a paper on "The Carbonisation of Coal in Vertical Retorts," and began by giving a comprehensive summary of the different attempts which had been made to carbonise coal in vertical retorts. He explained that the use of vertical retorts originated many years ago, when they were employed for the carbonisation of shale for the production of paraffin oil. In 1874 Andrew Scott, of Musselburgh, introduced a vertical retort to the lower portion of which steam was admitted for the production of water gas. Other pioneers of the system were W. R. Herring, of Edinburgh, John Brunton, who in 1828 patented an intermittent system, and Rowan, who in 1855 patented a system in which the coke was discharged from the bottom of the retort through a water bosh. Reference was also made to the work of W. Padfield and Dr. J. Bueb, whose system was introduced into England by the Vertical Gas Retort Syndicate, Ltd., and notable examples at present in operation were cited, the latest developments being the Deasan Intermittent Vertical chamber ovens. The modern systems of Woodall-Duckham, Glover West, the Glasgow and Dempster-Toogood were described at length.

The advantages claimed for the vertical as compared with the horizontal retort system were, the author went on to say:—(*a*) Continuous production of gas; (*b*) the elimination of much labour by using the force of gravity to cause the coal to pass continually into and out of the retort; (*c*) the flexibility of the system in enabling gas of varying calorific value to be easily obtained; (*d*) the low temperature of the coke discharged and consequent reduction in amount of quenching water required; and (*e*) the much greater cleanliness of all the operations.

The author considered the increased capital outlay involved in the use of vertical retorts was offset by the advantages mentioned, but agreed that, where horizontal retorts were already installed, they were likely to remain and give good service for a long time to come.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Business Still Lagging.

Work has now been generally resumed at the mills, forges, and factories in the Midlands and Staffordshire, but unfortunately those which had hardly any orders in hand when they closed down for the Easter holidays are not appreciably better off now. In the circumstances the demand for raw materials is severely restricted, and forward commitments do not receive much consideration. While depression is general, the outlook is slightly more hopeful, mainly because a few inquiries have come to hand, but there was very little business transacted on 'Change in Birmingham to-day—Thursday. Consumers of iron and steel were anxious to fathom the depth of price depreciation, for, with the exception of galvanised sheets, which have appreciated a further half-crown, values showed further weakness. Steel, alike raw and finished, was cheaper, but there was no appreciable alteration in iron. With values so irregular business continues to be withheld.

Steel Prices.

The position in the steel trade is easier as the result of the decision come to last week-end at the conference of steelmasters. Both producers and consumers now know where they stand, and are ready to enter into negotiations for supplies. There is now a free market in ship, bridge and tank plates. For some time past the prices of steel sections have proved uncontrollable in practice, but till very recently makers in the Midlands, in common with those in other areas, had adhered to the quotation of £9 15s. for ship, bridge and tank plates ¾in. and over. The breakaway by producers on the North-East Coast, followed by reprisals on the Clyde, compelled a reconsideration of the position. The Steel Manufacturers' Association in conference last Friday found it impossible to reconcile the views of representatives of the different districts. Individual firms will, therefore, make their own prices. It was reported on 'Change in Birmingham this week that business was being done by Northern houses at £9 5s. These prices would involve so much loss in the Midlands that mill owners will not entertain them. A common price has been agreed upon for boiler plates; the basis will be £13, a reduction of 10s. on the rate previously prevailing. With regard to sections, it is understood that a free hand has been given to associated firms to enable them to meet the competition of those outside. The control has ceased to be much more than nominal for months past, the official figure to £9 5s. being quite unobtainable. Business has been done for several weeks past, as reported in this column, at £8 15s., and this week there has been a further fall to £8 10s. Orders for constructional steel are still appearing in fair quantity, the chief deficiency being rail and shipbuilding contracts. There are some slight signs of improvement in shipbuilding demands, but these are far below the normal. Under the pressure of foreign competition, native billets, after remaining firm for some time, are now half-a-crown below the £7 figure. Belgian billets can be bought at £6 5s. There is, however, less keenness on the Continent for English orders, and deliveries are slower.

Galvanised Sheets.

Makers of galvanised sheets continue to receive good inquiries and fair business, enabling them to increase their basis to £16 12s. 6d., with a premium for small lots and quick deliveries. Inquiries promise activity at least until the summer. This line maintains an excellent export business. The steady upward trend of trade was maintained in March, with an export of 65,351 tons, against 64,350. Sales have been less satisfactory of late however. Black sheets are called for for a variety of requirements, several Birmingham industries being good customers.

Scrap.

Steel scrap is selling slowly. Contracts are said to have been accepted at very low prices, including £3 12s. 6d. delivered in South Wales.

Finished Iron.

The depression in the Staffordshire finished iron trade shows no signs of lifting. The new local orders placed for rolling stock will make demands upon the Staffordshire mills for wrought iron or re-rolled steel. Steel is largely substituted for iron for this class of railway construction. That, however, is merely a continuation of a change-over which has been in progress for some time. Statistics of imports show that rather large quantities of Belgian billets have been coming in, a fair proportion for re-rolling in Staffordshire mills. Prices cannot be said to be strong. The bar mills stick to the official declarations, but producers who are in a position to command overseas trade are ready to deliver f.o.b. Crown bars at £12, and common bars at £11 5s. Makers of wrought iron gas tube strip are badly off for orders, but tube mills have a considerable aggregate of work on hand. Steel appears to be usurping the place of iron in an increasing degree on account of its cheapness. Steel strip can be bought at about £9. Marked bars for home consumption are in moderate demand, but hardly maintaining the scale of the earlier months. Crown bars are still quoted £12 15s., but this figure is frequently shaded. Belgian nut and bolt iron competes with the Staffordshire product. It, however, is 7s. 6d. dearer at £7 15s. delivered, although easily competing with Staffordshire iron, costing £11 15s.

Pig Iron.

Users of pig iron in the Midlands are becoming very short of supplies, and founders, whose plant is constantly at work, are issuing small orders for prompt delivery. Blast-furnacemen are being sounded to ascertain the extent of the concessions they would be prepared to make in return for orders of any size. With few exceptions they adhere to their recent quotations. Very low prices have been mentioned in relation to forge pig, but the market is so dead that deductions might very well be mistaken. Smelters as a whole are not disposed to cut the price further. They do not think it would promote trade if they did so. Undoubtedly late quotations have been shaded. For Northamptonshire foundry £3 11s. 6d. is generally acceptable, and £3 10s. is said to have been taken by some furnaces. For No. 3 Derbyshire houses are making a resolute stand at £3 17s. 6d. It was commented on at the weekly market in Birmingham to-day that we imported more pig iron in March than we had done in any month since 1921. There were landed at our ports 13,770 tons of forge and foundry pig, against 7929 tons in February and 19,587 tons of basic, against 15,633 tons. Our export of forge and foundry qualities declined from 30,810 tons to 26,554 tons. More iron produced by the acid process was exported, the total being 12,540 tons, against the very low February figure of 9586 tons. It is noted that we are not selling nearly half the amount of pig iron abroad as was our custom two years ago.

Production Statistics.

The statistics of production for March are rather more favourable than was anticipated, the output of pig iron being 607,900 tons, against 541,900 tons in February and 668,600 tons in March, 1924. The furnaces in blast at the end of the month numbered 169, a net increase of four since the beginning of the month. The production includes 190,400 tons of basic, 148,900 tons of foundry, and 27,500 tons of forge pig iron. The production of steel ingots and castings amounted to 684,700 tons, compared with 652,300 tons in February. The latter is the best total since July of last year, and compares with a pre-war average of 638,600 tons. As the production has been entirely to meet immediate wants, the figures are considered rather satisfactory. It will be noted that the output is nearly 50,000 tons in excess of the pre-war figure, and the unemployment is mainly due to the very large increase in capacity since the war and the larger production per man employed.

Coventry Engineering.

Coventry's engineering works continue in full swing, and, judging by the manner in which the demand for the city's principal products is keeping up, there is every reason to suppose that, given industrial peace, the motor and cycle trades will remain busy for several months ahead. The local branch of the Amalgamated Engineers' Union has endorsed the action of the Executive Council in resisting the introduction of any conditions regarding the application for a wages advance, but, for the sake of all concerned, the hope is earnestly expressed that a spirit of co-operation will prevail, and that the satisfactory conditions which now obtain in Coventry may continue. Other phases of the city's industries are in a healthy condition, telephone and wireless apparatus manufacture continuing bright spots. Another satisfactory feature in electrical development, in which Coventry now plays an important part, concerns the manufacture of magnetos, a branch of the business which was formerly almost entirely in the hands of the foreigner.

Cannock Chase Pit Closed.

The Great Wyrley Colliery, Cannock Chase, closed down on Saturday last, all efforts to keep it going having failed. Between 600 and 700 miners and others employed at the colliery are thrown idle. As reported in my letter to The Engineer of the 10th inst., the shareholders recently decided to close the pit owing to heavy financial losses sustained by the company during the last three or four years. There does not appear to be the remotest prospect of the colliery being reopened in the near future, notwithstanding that a considerable area of coal has yet to be got. A small number of the workers have been retained for the purpose of taking up the rails and removing girders, &c. About a third of the men and youths affected by the closing down of the pit belong to Cannock, Wyrley, and Cheslyn Hay districts, and the majority of these are likely to find employment at the other local collieries. The other men dismissed belong to Bloxwich, Leamore, Walsall, and surrounding districts.

Wolverhampton Electricity Extensions.

Wolverhampton Town Council on Monday decided upon the provision of a new electric generating set, to cost £44,000, and important electrical extensions rendered necessary by increased demands for current. It also approved a series of recommendations by the Electricity Committee for extensions to plant, &c., involving a considerable expenditure. It was decided to replace two old turbine sets of 5000 kilowatt capacity by a new 75,000 kilowatt turbo generator at an estimated cost of £44,000. The tenders of the British Thomson-Houston Company, Limited, for a new turbo alternator set, of W. H. Allen, Sons and Co., Ltd., for the necessary condensing plant, and of Reyrolle and Co. for an automatic oil switch were accepted. It was agreed also to spend £15,306 to give a supply of electricity to Messrs. Courtauld's new works, £8812 to extend the supply to Featherstone and Hilton, in the area of Cannock Rural District Council, where it is proposed to erect 450 houses, and £714 to afford an increased supply to A. J. Stevens and Co. (1914), Ltd.

LANCASHIRE.

(From our own Correspondents.)

Manchester.

General Outlook.

The general condition of the iron and metal markets here remains dull and quiet, and there is as yet no sign of the revival which was hoped for after the holidays. It is generally considered here that if there be no revival of trade before the Whit-week stoppage—which is the most important general stoppage in Lancashire—then one cannot expect anything until the late autumn. Those who take the pessimistic view of the position do not now look for any trade revival at all this year; and even people who usually take a cheerful view are realising that there are yet many difficulties in the way of recovering the trade of this country. The political disturbances on the Continent are sometimes given as a reason for the present dulness of the markets, but one cannot believe that they have any very serious effect. The causes are deeper and more permanent.

Metals.

The market in copper has become terribly depressed, and people in the trade are expressing very gloomy views as to the future. A long experience of the copper market shows that pessimism is very apt to be exaggerated; and that when things appear most gloomy is usually when a reaction is near at hand. One cannot, of course, speak with any certainty, but one is inclined to ask whether the fall in copper is not a little overdone. Standard copper prices have come down very steadily since the beginning of the year, the total amount of the fall, as I write, being about £9 per ton, or roughly 15 per cent.; but a rise of about £4 per ton had taken place in December, so that the early January prices were rather high. The market is now very nearly at the lowest point touched since the war; and although anything is possible, it is difficult to believe that it can go much lower. The fall in copper sheets and bottoms corresponds fairly well with the movement in standard and refined ingot copper. Tin has been a very unsteady market, and people engaged in the trade here seem utterly unable to form any opinion as to the probable course of prices. There is said to be an improvement in the American consumption lately, but it has had no definite effect on the market here. The exports of tin from the Federated Malay States for the first quarter of this year was nearly 1000 tons greater than last year. The markets for lead and spelter have been dull and rather weak. Consumers of lead are holding off still in the expectation of lower prices, and there would seem to be an ample supply for all probable needs.

Pig Iron.

There is no sign of revival yet in the foundry iron market here, and buyers are not inclined to give out orders. The business done is mainly of a retail character, and seems to be scarcely worth the trouble of doing. Consumers order two or three truck-loads as the iron is wanted, but the quantity of pig iron now being melted in the cupolas of the district must be small, or there would be a better demand for cast scrap for mixing purposes. The prices here do not show any definite change, but it is believed by buyers that the makers are more anxious to effect sales, and hence are disposed towards small concessions. Certainly, some sellers are rather squeezable, and it is said that Derbyshire No. 3 foundry can be bought at a little under 85s. per ton delivered in Manchester. The Northamptonshire brands are rather weak, and might probably be bought here at 83s. or 83s. 6d. delivered; but if Derbyshire can be obtained at under 85s. then there will be no great temptation to use Northamptonshire. The market for Scotch iron remains as it was, but now that Scotch costs nearly 20s. more than common iron, one cannot expect founders to be at all enthusiastic about using it. Hematite pig iron is weak here at about 95s. delivered.

Finished Material.

There is no change in the malleable iron position. Lancashire Crown bar iron is too dear for the consumer; yet it is maintained that any lower prices are impracticable for the manufacturer. Of course, if that be so, then all that can be said is that the Lancashire malleable iron industry is in a serious condition. The market for manufactured steel is in a confused state, consequent upon the failure of the London meeting to reach any decision about the prices. Here, it is understood that the makers have a free hand and can take orders for plates at any price they like. The meaning of this is, of course, that a severe competition will set in for the few orders that come into the market, and that prices will sag until a lower level is reached. For boiler plates a reduction of 10s. was notified.

Scrap.

The market for scrap material is as dead as it can be. There is no demand yet for steel scrap, and dealers here are offering only 55s. per ton for the heavy melting qualities, of course without guarantee of analysis. Special scrap of guaranteed quality would cost more. For flat spring steel—in leaves—about £5 10s. is the value here. Heavy wrought scrap is still worth from 80s. to 85s. per ton delivered at the works, and cast scrap is quoted at 77s. 6d. to 85s. per ton, according to quality; but there is only a small demand for it.

Barrow-in-Furness.

Hematite.

There is no improvement in the hematite pig iron trade in this district, but the fact that makers are keeping the thirteen furnaces going is a sign that they are hoping for, or perhaps expecting, a better demand in the near future. The steel works are, of course, taking a fair amount of iron at Barrow and Moss Bay, particularly the former, but other works which have not got steel departments are no doubt having to stock to some extent. The trade with Scotland is not at all large. Compared with what it was a few months ago, it has fallen off very much, and business with other parts of the country, particularly the Midlands, leaves room for much improvement. Continental trade is very dull, but orders keep coming from America, and Barrow has an order in hand for that country at the moment.

Iron Ore.

The state of the iron ore trade is a reflection of the local iron trade. None of the mines are bringing up more than is needed to meet local requirements, plus the

small tonnage which is going out of the district. There is no improvement in the ore trade with Scotland. Foreign ore continues to arrive in moderate quantities, and there was another cargo into Barrow from Kirkenes.

Steel.

The steel trade shows no alteration. Barrow has sufficient orders to keep the rail mills going for a few weeks, but fresh orders are needed, and with the market as keen as it is, they are hard to get. The Workington mills are partially employed, that is to say, they are working off and on, with insufficient orders to keep them going regularly.

SHEFFIELD.

(From our own Correspondent.)

Iron and Steel Position.

No additional post-holiday orders have come to the crude iron and steel trades, which are in a very quiet state. There is an almost complete absence of forward buying, and that is so both with pig iron and with steel billets. Users are content to buy from day to day, according to their immediate requirements, which are not large. Basic steel is as badly off as any section, and, though acid steel is accounting for the larger part of the output, the call for it is not nearly so great as it should be, particularly in view of the present demand for railway material. This is the period of the year when companies hold their annual meetings, and the speeches of the chairmen have not been of a very encouraging nature, even in the case of those concerns which have been able to pay a dividend on the ordinary shares. Unfortunately, the time when there might have been an improvement has now passed for the present, the iron and steel trades being on the verge of what is always a quiet period of the year. In keeping with this suggestion is the fact that inquiries can almost be described as being few and far between.

Heavy Engineering.

The heavy forgings and castings departments are experiencing great difficulty in getting sufficient work to enable them to run on profitable lines. Overhead charges and maintenance costs generally have been cut to the limit, but in the absence of any really big work producers are satisfied if they can meet their expenses. Naval and armament work is scarce, reflecting the quietness which prevails in the shipbuilding yards. Railway work for the home companies is still in hand, and is accounting for most of the activity at the Sheffield and district plants. A good deal of foreign work is being thrown open for contract, but unfortunately Sheffield is unable to secure much of it. Owing to the lower prices that can be quoted, a lot of orders for South America, India and other countries, even including our own Colonies, are going to France, Belgium and Germany. Comparatively small contracts for railway work reach this country from time to time, but the Sheffield works would be very glad of, and could readily accommodate, a great deal more of that class of product. The private wagon trade is still in the middle of a quiet patch, though there is a moderate call for repair work.

The Lighter Trades.

In the lighter branches trade is much better than in the heavy departments, but since Easter there has been a falling off in production, which is probably indicative of the approach of the usual easier purchasing period. For files and engineers' small tools in particular there is a diminished call, and the export trade is displaying less vitality than it did a few months ago. The cutlery and plate trades do not report full order books. Business continues to drop away and many firms are noticably short of work. Stainless cutlery is now being sold chiefly by the smaller firms, not to all of whom is quality the first consideration. Competition to get business is keen, and this is resulting in extensive price-cutting. As a result, the old-established reputable firms, which still maintain a very high standard of craftsmanship, are being passed over, for they are quite unable to bring their prices down to the competing level. Buyers to-day are forced to pay more attention to price than to quality. Tenders are invited by the Admiralty for 60,000 nickel-silver spoons and forks, and by the Army for 5000 table knives with electro-plated handles.

Lead Mines Developments.

The Peak District is at present receiving attention again as a probable source of lead ore. A London syndicate has had engineers there for several days, testing and estimating the value of the mines, numbering about sixty, in the valley of the Derwent, from Matlock to Matlock Bath and Cromford. The statement is made officially that the scheme is to unwater and work the mines, and that a company is to be formed with a capital of £100,000. The view held in the district is that although the mines of the right bank of the Derwent have been worked out, those on the left back are still full of lead, and that pumping machinery can produce some of the wealth that now lies below water level.

Hornsea Water Scheme.

The Hornsea Urban Council is applying for powers to borrow £23,900 to carry out a new scheme of water supply from Aike, about 12 miles from Hornsea. Application has been made to the Unemployment Grants Committee for financial assistance. The Bewholme-lane supply has been put into use as a temporary source, but the Ministry of Health refused to agree to that source being made permanent on the grounds that it was insufficient to meet the future needs of the town. Some time ago Mr. E. J. Silcock, a consulting engineer, was called in, and he submitted plans and estimates for the Aike scheme. It was, however, laid aside at first, owing to some difficulty over borrowing powers, but as that is no longer an obstacle, the Aike scheme has been taken up again, and the plans and estimates approved.

Saving Scarborough Drive.

Four schemes have been placed before Scarborough Corporation for the saving of the Royal Albert Drive in the North Bay, which is in danger of a serious break. One of the schemes recommended is the building of a circular bay outside the weakest portion of the wall, the estimated cost being £84,000. A second suggestion is the construction of a "wave breaker," consisting of big concrete blocks, the cost in that case being £45,000. The borough engineer has produced two other less costly schemes, one being to set the wall back for some distance.

NORTH OF ENGLAND.

(From our own Correspondent.)

Control of Steel Prices Abandoned.

The abandonment of the control of steel prices in the home market brought about at the beginning of the week has not occasioned any surprise in steel trade circles in the North of England. It was generally felt that such a step was bound to come sooner or later. The associated manufacturers revived the system in November, 1923, and, except for a few weeks last year when the Scottish makers broke away, it has been, at least nominally, in force ever since. But under pressure of competition and the dire necessity of securing orders to keep plant in operation, there have been frequent breaches of the agreement. More or less surreptitiously, cutting has been going on, and when at the end of last month North-East Coast manufacturers announced a reduction of 7s. 6d. per ton in the price of steel plates and sections, it proved the breaking point. At all events, price control has now been definitely abandoned, and each maker is free to fix his own prices. It is not likely to lead to further cuts of any moment, as prices are already down to an almost unprofitable level, but it does give greater freedom to the owners of the more modern plants in this district to take full advantage of their ability to produce and deliver steel manufactures at a cheap rate.

Cleveland Iron Trade.

The Cleveland pig iron trade presents few new features of moment. The market still rules on very quiet lines, and makers are having considerable difficulty in keeping their furnaces in operation. This is a period of the year when there is usually a seasonal expansion of business, but there are faint signs of any improvement as yet. Pig iron prices are down to a level comparable with those on the Continent, and there is rather better inquiry from European consumers, but the limited volume of business leads to the conclusion that consumers' needs on the Continent are very small, and difficulties in relation to credits and fluctuating exchanges all exercise a restrictive influence. Home industrial needs are also limited, and the best that can be said is that prices have not sagged further. No. 3 G.M.B. Cleveland pig iron is 77s., No. 1 foundry 82s., No. 4 foundry 76s., and No. 4 forge 75s.

Hematite Pig Iron.

The East Coast hematite pig iron trade shows no improvement whatever, and it is expected that the projected stoppage of the Thornaby Ironworks, where two hematite furnaces have been in blast, will be completed this week. This will reduce the number of furnaces in blast on the North-East Coast to thirty-eight, of which only ten are on hematite. The price of mixed numbers is variously quoted, but supplies are obtainable at 82s. per ton, and 6d. per ton premium is asked for No. 1 quality.

Iron-making Materials.

Little movement is reported in the foreign ore trade. Freights are extremely light at the moment, but works are heavily stocked, and are not buying, only an occasional spot lot changing hands on the basis of about 22s. per ton for best Rubio ore, c.i.f. Tees. Sellers still quote 22s. 6d. per ton for Durham furnace coke delivered at the works, but it is full price, and coke could possibly be bought at 22s. per ton.

Manufactured Iron and Steel.

Whilst conditions in the manufactured iron and steel trade are still very unsatisfactory, a slightly better feeling has been noticeable in the market this week. Transactions in nearly all branches continue on a disappointing scale, but in one or two departments they have shown some expansion. Inquiries on overseas account are reported to be just a little better. Common iron bars have been reduced this week by 7s. 6d., bringing the price down to £11 12s. 6d. per ton. Other prices are unaltered.

The Coal Trade.

Business in the Northern coal trade shows no signs of any new development in the demand for any class of coals, and the outlook is very discouraging. Fitters are finding it more and more difficult to secure orders from the Continent, while the home demand has fallen away considerably, as is usual at this period of the year, owing to the diminishing requirements for gas and electricity undertakings and for household purposes. The present output, which is the lowest recorded for many years past, is still much in excess of the demand, and the question of closing more collieries appears to be only a matter of time, in view of the substantial losses which are being incurred. The position regarding best Northumberland steam coals is fairly satisfactory to the end of the month, but most of the collieries still have a good surplus after meeting their commitments, and values are just steady; in fact, there is now little difference in the quotations for any quality of steam coals. Best steams are quoted nominally at 17s., and might be fractionally discounted. Hastings or West Hartley Main or similar are quoted by direct sellers at 16s. 9d., and through second hands 16s. 6d. Tyne primes are also quoted at 17s., with merchant holders offering at 16s. 9d. Thus, the difference in price of all these grades is limited to a copper or two. Gas coals are a very quiet trade, and prices are easy in tone. There is nothing special in the position of other qualities, which are easily obtainable, and while prices are unaltered, the tone is just barely steady. The coke trade is slightly more active, but abundant supplies prevents the demand being reflected in higher prices.

Cleveland Miners' Wages.

Wages in the Cleveland ironstone mining industry were under consideration at a joint meeting of mine-owners' and miners' representatives at Middlesbrough on Monday. After a protracted discussion, it was decided that wages should be reduced, in accordance with the ascertained selling price of pig iron, by 1.8 per cent. The reduction will take effect from Monday next. The special claim made by the men for an advance, apart from the sliding scale, to meet the high cost of living, was also under consideration. It was intimated by the owners that the present condition of the industry afforded little prospect of any substantial concession being made, though something might be done for the lower-paid men. The employers appointed a sub-committee to meet the men's representatives on May 4th to go into the question.

SCOTLAND.

(From our own Correspondent.)

Steel Prices Decontrolled.

So far as the home market is concerned Scottish steel prices have been decontrolled, and the market is now a "free" one for ship plates and angles. Boiler plates, however, have been reduced 10s. per ton, making the official minimum £12 10s. per ton.

Featureless Markets.

The scarcity of fresh orders for all descriptions and classes of material is reflected in the various markets. A distinct lack of interest is evident on all hands, and depression is only too apparent. The dearth of foreign inquiries continues to play an important part, local producers being still unable to successfully meet continental competition, consequently any business passing is confined to small immediate requirements, chiefly for home consumption.

Pig Iron.

The pig iron market shows no sign of revival. The output is extremely small compared with the normal production, but stocks in makers' yards are not decreasing despite easier prices.

Steel.

Steel makers still report slow progress at the mills. Great difficulty is experienced in maintaining employment from week to week, the demands from shipyards and other centres of consumption being most restricted. This is especially the case with respect to plates and sections. The demand for black sheets, too, is becoming irregular, both for home delivery and for export. Exports in particular show a considerable falling off. It is therefore left to the galvanised varieties to uphold the note of firmness so long associated with sheets.

Bar Iron.

There is little or no change in bar iron. The recent 10s. per ton reduction in home prices has made little difference so far. It is said that general orders are a little more numerous, but that nothing in the way of a substantial order has been forthcoming. The re-rolled steel branch of the industry is practically stagnant.

Scrap.

The slight improvement in the demand for scrap has been maintained.

Coal.

The depression in the coal trade is perhaps more acute than it was last week. Exporters report an even greater dearth of inquiries from foreigners, while home demands are shrinking rapidly. Forward transactions are conspicuous by their absence, and collieries are eager to secure prompt orders to enable them to clear stocks at sidings. Demands from the Baltic are most disappointing and far below the usual for this period of the year. Business with Italy has eased off, and Lanarkshire splints have become cheaper and show a still weaker tendency. With the exception of treble nuts in Fifeshire and the Lothians, all descriptions of fuel can be obtained at cheap prices. Employment is most irregular, and in view of oncosts it is probable that a number of collieries will close down very soon. Aggregate shipments amounted to 205,428 tons, against 246,211 tons in the preceding week and 265,687 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Position.

Steam coal trade conditions have not undergone much, if any, alteration, and at present signs are not in evidence of the much-desired revival in business. Coal exporters and coal owners did not find after the Easter vacation that there had been an accumulation of orders. The amount of fresh business which has come along is very meagre, and the experience of most people in the trade is that orders are extremely hard to get, and when obtained the maximum amount of difficulty is encountered in executing them without making a loss. These are not very encouraging conditions, but most firms are facing them as bravely as possible, in the hope that some day

there will be a change for the better. The anthracite section of the market is quite good, and most qualities, especially sized coals, give every appearance of improving as the result of the heavy shipments which are being made for Canada, and will continue during the next few months. In the case of steam coals, this market can only be described at the best as somewhat erratic, especially for prompt loading. The tonnage position is not as favourable as might be the case, as will be gathered from the fact that the number of steamers awaiting a loading berth is less than the number of such berths available. It will therefore be seen that the loading facilities of the docks are not being worked to their full capacity. Many collieries are unable to effect the quick shipment of their coals, with the consequence that standing stocks are heavier than is desirable. Reports show that here and there orders are being captured by German and American coals, but, on the other hand, Sir Alfred Mond, who is interested in cement works in Palestine, has announced that he has concluded a contract for 30,000 tons of Welsh coals, and it is satisfactory to find that the Portuguese State Railways have placed orders with two Cardiff coal-exporting firms for 31,000 tons of large and small coals for delivery over the next ten weeks. One company is to supply 21,000 tons, of which 15,000 has to be delivered at Lisbon and 6000 tons at Villareal, while the remaining 10,000 to be supplied by the other firm has to be shipped to Oporto. In actual price the Germans were very close competitors for the business, there being less than 1d. per ton difference between the prices for Welsh coal, as compared with the German commodity, but the superior quality of coals from this district more than compensated for the disparity in price.

Non-unionist Question.

At their last monthly meeting the decision was come to by the Rhondda No. 1 district that notices should be tendered throughout the district, and in accordance with this, the lodges were instructed to serve the notices on Monday last, which means that they will become operative on May 4th. If these notices are acted upon, it is probable that 40,000 miners will be affected.

Steel Trade Depression.

On Saturday last the Albion Steel Works, Briton Ferry, which are owned by the Briton Ferry Steel Company, Ltd., closed down for an indefinite period, owing to the slackness of trade, with the result that over 500 hands are affected. Notices have also been posted up at the Llanelly Steel Company's works informing the men of all grades that half time only will be worked until further notice. The notice points out that the works have been kept going for the last few weeks under great difficulties, and the company is now reluctantly forced to take this course, owing to the shortage of orders consequent upon the slump in trade.

G.W.R. and South Wales Ports.

An interesting visitor to South Wales last week was Mr. C. J. Smith, successor to Mr. W. Phillips in the position of vice-president in charge of the European affairs of the Canadian National Railways and Canadian Government Mercantile Marine, Ltd. An inspection of the various docks and their appliances was made, and an opportunity afforded of meeting local traders, with a view to discussion and improving trade relations with Canada. The view was expressed by Mr. Phillips that traders at Cardiff with the vast population behind the city were not making the most of their opportunities to use Cardiff as a distributive centre. Instead of there being a fortnightly steamer service between Cardiff and Canada, there should be, he said, sufficient trade to establish a weekly service. Speaking on behalf of the Great Western Railway Company, Mr. C. S. Page, the assistant docks manager, said that the Great Western Railway Company could be relied upon to give active consideration to any requirements of the Canadian trade. Since they had become the owners of the docks, the company had done a great deal to improve facilities. They had had the docks hardly three years, during which time they had provided two very large groups of sidings at Cardiff for the handling of coal for shipment. At Cardiff and Newport the expenditure involved in such improvements had amounted to over half a million pounds, in addition to which considerable sums had been voted and spent in providing improved general cargo cranes. The new suction grain elevator at Cardiff enabled them to discharge grain in bulk out of vessels at a speed previously unknown in the history of the port, and he was hopeful that now they had one such elevator, they would soon obtain another. The Great Western Railway Company was also spending vast sums in altering tips for the shipment of coal. The whole of the tipping appliances at the docks were to be fitted or constructed for the handling of 20-ton wagons. When the time arrived that 20-ton wagons were generally in vogue, it would mean a revolution in the shipment of coal from South Wales.

The Vauxhall Experiment.

The experiment between the owners and the miners at the Vauxhall Colliery, Ruabon, which so far has been such a success is to be of comparatively short duration; in fact, it may terminate at the end of the agreed period of three months. There was a meeting of the Council of the North Wales Miners' Association at Wrexham on Monday, when the matter came up for discussion, and a resolution was passed that in view of the members of the Vauxhall lodge having expressed regret, and having promised to recover the old price list rates after the termination of the temporary period of three months, and in view of the weakening effect of such an experiment upon the position of the miners in general in relation to their working hours and conditions, the matter was left in abeyance for two months. Mr. J. T. Edwards, the delegate of the Vauxhall lodge, gave a promise that he would withdraw from the guarantee bond and the men would endeavour to regain the original price list in operation at the colliery. In view of later developments it seems likely, however, that the experiment will continue.

Better News for Miners.

The notices to terminate the employment of about 2500 miners engaged at Nixon's Navigation Colliery, Mountain Ash, expired on Saturday last, but the announcement was made early this week that they would not take effect, as work would be continued on a day-to-day contract.

Swansea Metal Exchange.

Mr. F. W. Gilbertson was on Tuesday re-elected president of the Incorporated Swansea Metal Exchange, when he stated that recent legislation was making the position worse for industry. The omens for prospects of the iron and steel industry were bad. It was terrible for home manufacturers to be handicapped by costs so enormously in excess of their competitors. At the moment there was no prospect whatever of reduced costs of production.

Current Business.

On the whole, the steam coal market has not undergone any material change as regards values. Second qualities of Admiralty large coals are relatively steadier, and better stemmed than some of the best coals. Dry coals are quiet in demand, and Monmouthshire descriptions are irregular, and in some instances short of prompt orders. Superior smalls are fairly steady, but inferior sorts are rather plentiful. Coke and patent fuel are barely maintained. In the anthracite section, sized coals are in short supply, owing to the heavy shipments which are being made, more particularly for Canada.

INSTITUTE OF TRANSPORT.

THE Fifth Congress of the Institute of Transport will be held in London from May 13th to 16th inclusive. The following programme, which, however, is subject to modification, has been arranged :—

On the morning of Wednesday, May 13th, at 10 o'clock, a meeting will be held in the Lecture Theatre of the Institution of Electrical Engineers, Victoria Embankment, for the consideration of the following papers :—(1) "Ministry of Transport Requirements, 1925," by Colonel Sir John Pringle, and (2) "Airships and their Uses both as Commercial Vessels and in Time of War," by Commander C. D. Burney, N.R. In the afternoon there will be alternative visits to :—(*a*) The works in course of construction for the London Underground Railways; (*b*) the Great Western Railway Goods Station at South Lambeth and the works of the Vacuum Oil Company, Limited, at Wandsworth. The sixth dinner of the Institute will be held at the Hotel Cecil at 6.30 for 7 p.m.

On the Tuesday morning, at 10 o'clock, there will be a further meeting at the Institution of Electrical Engineers, when a paper by Mr. D. R. Lamb, entitled (3) "The Co-ordination of Rail and Road Transport," will be discussed. In the afternoon there are to be alternative visits to (*c*) the Metropolitan Railways new signal cabin at Baker-street Station, and the Rickmansworth–Watford Extension; and (*d*) the factories of J. Lyons and Co., Ltd., at Greenford.

On the Friday morning—again at 10 o'clock at the Institution of Electrical Engineers—the members will meet to discuss the following papers :—(4) "Arterial Roads in Relation to Town Planning," by Mr. A. E. Brookes; and (5) "Modern Dock Equipment," by Mr. H. J. Deane, M. Inst. C.E. For the afternoon the following alternative visits are proposed :—(*e*) To the Royal Victoria and Albert and King George V. Docks; (*f*) the Royal St. Katherine Dock Warehouses; and (*g*) the Pakenham-street Garage, City Basin Depôt, &c., of Carter, Paterson and Co., Ltd.

Saturday, the 16th, has been set aside for an inspection of the Eastern-avenue and the New Southend road.

Further particulars of the Congress can be obtained on application to the secretary, Mr. A. Winter Gray, 15, Savoy-street, London, W.C. 2.

LAUNCHES AND TRIAL TRIPS.

THISBE, self-trimming collier; built by Blyth Shipbuilding and Dry Docks Company, Ltd., to the order of G. Lamy and Co.; dimensions, 271ft. by 37ft. 8in. by 18ft. 7in.; to carry 2420 tons. Engines, triple-expansion, 21in., 34in., 56in. by 36in. stroke; constructed by the North-Eastern Marine Engineering Company, Ltd.; trial trip, April 4th.

INVERPOOL, single-screw steel steamer; built by Harland and Wolff, Ltd.; dimensions, 169ft. by 31ft. by 14ft. 6in. Engines, triple-expansion, surface condensing; constructed by the builders; launch, April 6th.

BEACON, steamer; built by J. I. Thornycroft and Co., Ltd., to the order of the Corporation of Trinity House, of Deptford Strand; dimensions, 160ft. by 27ft. 6in. by 14ft. 9in. Engines, two sets of triple-expansion, 11in., 18in. and 29in. diameter by 21in. stroke; constructed by the builders; launch, April 8th.

FORRESBANK, twin-screw motor vessel; built by Harland and Wolff, Ltd., to the order of Andrew Weir and Co.; dimensions, 434ft. by 53ft. 9in. by 37ft.; 5200 gross tonnage. Engines, two sets of six-cylinder motors with electrically driven auxiliaries; constructed by the builders; launch, April 8th.

KONINGIN ELISABETH, single-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Société Anonyme Belge d'Armement et de Navigation; dimensions, 315ft. by 45ft. by 22ft. 10in. Engines, inverted direct-acting triple-expansion, working on three cranks; constructed by the Wallsend Slipway and Engineering Company, Ltd.; launch, April 8th.

WAWA, steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of the Bragman Bluff Lumber Company; dimensions, 265ft. by 38ft. broad. Engines, triple-expansion; constructed by the builders; trial trip, April 8th.

SAMBUR, steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of the Great Western Railway; dimensions, 210ft. by 33ft. 6in. beam; 600 tons deadweight. Engines, twin-screw triple-expansion; constructed by the builders; launch, April 9th.

MARIANA, twin-screw tanker; built by Rotterdamsche Droogdok Maatschappij, to the order of the Curacaosche Scheepvaart Maatschappij; dimensions, 305ft. by 50ft. beam; 2320 tons deadweight. Engines, two triple-expansion; constructed by the builders; trial trip, April 10th.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

DELCO–REMY AND HYATT, Ltd., have opened new offices and works at 111, Grosvenor-road, London, S.W. 1. New telephone numbers, Franklin 6446, 6447, 6448 and 6449. New telegraphic address, Delremhyat, Churton, London.

JAMES GORDON AND CO., Ltd., of Windsor House, Kingsway, London, W.C. 2, ask us to announce that they are now acting as successors to the late Major S. Utting for the sale of the Thermix air heater of the Emile Prat systems of mechanical draught.

MR. R. LOXLEY How informs us that he has formed a limited liability company of Frank How and Co., of Trogon Wharf, 77–83, High-street, Stratford, London, E. 15, and that in future the firm will trade under the name of Frank How and Co., Ltd., Mr. How acting as governing director.

THE RANSOME MACHINERY CO. (1920), Ltd., asks us to state that the address of its London office has been changed from 14–16, Grosvenor-gardens, S.W. 1, to Windsor House, 42–50, Victoria-street, S.W. 1. The telephone number remains the same —Victoria 8060—and the telegraphic address is still "Ransomaco, Sowest, London."

MR. A. E. PHILPOTT, who has for the past six years traded as an engineer's representative and merchant under the title of A. E. Philpott and Co., at 76, Victoria-street, Bristol, informs us that he has been joined in active partnership by Mr. H. A. Cowlin, and that the firm will, in future, trade under the new style of Philpott and Cowlin, Ltd.

THE directors of Siemens Brothers and Co., Ltd., announce that owing to advancing years Mr. George Chauvin has resigned the position of managing director of the company, which he has held since April, 1899, during which time the works and manufacturing activities of the company have been very largely expanded. The company, however, will continue to have the benefit of his experience and advice, as he will retain his seat on the board as a director. The board has appointed Mr. Francis Hird, M.I.E.E., to succeed him as managing director.

CONTRACTS.

FOR a repeat order, the Riley Stoker Company, Ltd., of Palace Chambers, Bridge-street, S.W. 1, London, is constructing stokers 25½ft. wide, each of which, although burning low-grade coal of only 8500 B.Th.U. per pound as fired, is intended to fire a boiler capable of evaporating 100,000 lb. actual steam hourly.

THE General Electric Company, Ltd., of Magnet House, Kingsway, London, has recently secured, in direct competition with the largest continental manufacturers, an order from the Stoomvaart Maatschappij Nederland, of Amsterdam, for the complete electric cooking equipment for the new passenger boat the Pieter Cornelius Hooft, now being built in the South of France.

BUS-BARS AND CONNECTIONS.—Early last year the British Engineering Standards Association issued a standard specification for the marking of switchboard bus-bars and connections (No. 158, 1924), and a new specification, just issued, refers to the quality of metal, limits of temperature rise and current density, joints between conductors, and also includes recommended sizes of flat and round bars, both for copper and aluminium. Copies of the new issue are obtainable from the B.E.S.A., Publications Department, 28, Victoria-street, London, S.W. 1, price 1s. 2d. post free.

SOUTH AFRICAN YEAR BOOK.—The Year Book and Directory of the *South African Mining and Engineering Journal*, which has just come to hand, is as extensive and comprehensive as usual. The directory section, which occupies about a quarter of the volume, has been corrected right up to the date of printing, and is itself sectionalised effectively. The general information covers not only the Union, but also includes Rhodesia and the Katanga, and has been enlarged by information recently secured by one of the editors in the course of a tour through the outlying districts. It is noteworthy that no great prominence is given to the recent developments in platinum prospecting.

THE INSTITUTION OF MINING AND METALLURGY.—The Gold Medal of the Institution of Mining and Metallurgy has been awarded to Dr. Richard Pearce, M. Inst. M.M., in recognition of his life-long services in the advancement of metallurgical science and practice. The Council of the Institution has also awarded "The Consolidated Gold Fields of South Africa" Premium of forty guineas to Mr. Thomas Pryor, M. Inst. M.M., for his paper on "The Underground Geology of the Kolar Goldfield," and the "Arthur C. Claudet" and "William Frecheville" Students' Prizes of ten guineas each to Mr. F. H. Edwards, B.Sc. (B'ham.), and Mr. D. W. Bishopp, A.R.S.M., respectively.

ROYAL AIR FORCE DISPLAY.—The Royal Air Force Pageant, which was instituted in 1920 and has now been re-named the Royal Air Force Display, will take place on Saturday, June 27th, at the London Aerodrome, Hendon. His Majesty the King, Chief of the Royal Air Force, hopes to be able to attend. This annual review of the flying units is an integral and important part of the annual training of the Royal Air Force, and provides a valuable stimulus to keenness and efficiency in the many squadrons taking part in the inter-unit competitions and displays. A programme has been arranged which, it is anticipated, will fully equal that submitted in previous years, and new features are being introduced which will enable the public to appreciate the developments that are constantly taking place in the aerial arm. As in the case of the Royal Tournament all the proceeds are devoted to Service charities.

ENGINEERING GOLFING SOCIETY.—The spring meeting of the Engineering Golfing Society will be held at Rye, on Saturday and Sunday, May 23rd and 24th, by the courtesy of the Rye Golf Club. The following programme has been arranged :—On the Saturday, in the morning, there will be an 18-hole round, four-ball foursome match play against bogey. There will be two first and two second prizes for this competition. In the afternoon there will be team matches—North *v.* South—and other matches will be arranged after the entries have been received. On the Sunday, in the morning, the "President's Challenge Cup," presented by Sir Alexander Kennedy, for members in the First Division, with handicaps of 10 and under, and the "Wilson Challenge Cup," presented by Mr. R. P. Wilson, for members in the Second Division, with handicaps of 11 and over, will be competed for, both in an 18 holes stroke competition under handicap. A memento and a second prize will be given in each division. There will also be a prize for the best scratch score, presented by the Captain. In the afternoon there will be further team matches—North *v.* South—and other matches will be arranged after the entries have been received. It is also proposed to hold during the coming season a Match Play Tournament, on lines similar to those of previous years, and running during May, June and July. Owing to the small number of entries for this tournament in the past two or three years, the committee feels that it will not be justified in carrying it through unless at least 32 enter; and members entering for it do so on this understanding. The entries for both the spring meeting and the Match Play Tournament close first post on Monday, May 4th. Further particulars concerning the meeting and tournament and the Society itself may be obtained from the hon. secretary, Mr. G. M. C. Taylor, Caxton House, Westminster S.W. 1.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	20/-
(1) Spanish	21/-
(1) N. African	21/-
N.E. Coast—	
Native	—
Foreign (c.i.f.)	22/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	4 11 6	—
No. 1 Foundry	4 10 6	—
No. 3 Foundry	4 8 0	—
N.E. Coast—		
Hematite Mixed Nos.	4 2 0	4 2 0
No. 1	4 2 6	4 2 6
Cleveland—		
No. 1	4 2 0	4 2 0
Silicious Iron	4 2 0	4 2 0
No. 3 G.M.B.	3 17 0	3 17 0
No. 4 Foundry	3 16 0	3 16 0
No. 4 Forge	3 15 0	3 15 0
Mottled	—	—
White	—	—
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	10 10 0	—
North Staffs. Forge	3 17 6	—
,, ,, Foundry	4 7 6	—
(3) Northampton—		
Foundry No. 3	3 11 6 to 3 14 0	
,, Forge	3 7 0 to 3 8 0	
(3) Derbyshire—		
No. 3 Foundry	3 16 6 to 3 17 6	
Forge	3 10 0	—
(3) Lincolnshire—		
No. 3 Foundry	4 2 6	—
No. 4 Forge	3 17 6	—
Basic	4 0 0	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 15 0 (a); 4 17 6 (b); 5 2 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	11 12 6	—
Best ,,	—	—
N.E. Coast—		
Common Bars	11 2 6	—
Lancs.—		
Crown Bars	13 0 0	—
Second Quality Bars	12 0 0	—
Hoops	15 0 0	14 15 0
S. Yorks.—		
Crown Bars	13 0 0	—
Best ,,	13 10 0	—
Hoops	14 10 0	—
Midlands—		
Crown Bars	12 15 0	—
Marked Bars (Staffs.)	15 0 0	—
Nut and Bolt Bars	11 15 0	—
Gas Tube Strip	13 0 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	12 10 0	—
Ship Plates, ½in. and up	9 5 0	—
Sections	8 15 0	—
Steel Sheets, 3/16in. to ½in.	11 0 0	—
Sheets (Cal. Cor. 24 B.G.)	—	£17 to £18

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 17 6	—
Angles	8 12 6	—
Boiler Plates	13 0 0	—
Joists	8 12 6	—
Heavy Rails	9 0 0	—
Fish-plates	13 10 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	9 10 0	—
Soft Billets	8 10 0	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 15 0†	—
Light ,,	9 0 0 to 9 5 0	
Billets	8 0 0 to 11 0 0†	
Manchester—		
Bars (Round)	9 15 0 to 10 0 0	
,, (others)	9 0 0 to 9 5 0	
Hoops (Best)	15 5 0	15 0 0
,, (Soft Steel)	13 15 0	13 10 0
Plates	9 7 6	—
,, (Lancs. Boiler)	13 0 0	—
Sheffield—		
Siemens Acid Billets	11 10 0	—
Bessemer Billets	13 0 0	—
Hard Basic	9 10 0	—
Intermediate Basic	9 0 0	—
Soft Basic	8 0 0 to 8 5 0	
Hoops	12 0 0	—
Soft Wire Rods	9 10 0 to 11 0 0	
Midlands—		
Small Rolled Bars	8 15 0 to 9 15 0	
Billets and Sheet-bars	6 17 6 to 7 0 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	16 10 0 to 16 12 6	
Angles	8 10 0 to 8 15 0	
Joists	8 10 0 to 8 15 0	
Tees	9 10 0 to 9 15 0	
Bridge and Tank Plates	9 10 0 to 9 15 0	
Boiler Plates	13 0 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	22/1½ to 22/4½
Block Tin (cash)	£234 15 0
,, (three months)	£237 16 0
Copper (cash)	£59 17 6
,, (three months)	£60 12 6
Spanish Lead (cash)	£30 15 0
,, (three months)	£30 12 6
Spelter (cash)	£34 6 3
,, (three months)	£33 3 9
Manchester—	
Copper, Best Selected Ingots	£64 0 0
,, Electrolytic	£64 15 0
,, Strong Sheets	£89 0 0
,, Tubes (Basis Price)	£0 1 1
Brass Tubes (Basis price)	£0 0 11½
,, Condenser	£0 1 2
Lead, English	£33 5 0
,, Foreign	£32 0 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/9 per lb.	
Ferro Tungsten	1/6 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£24 0 0	8/-
,, 6 p.c. to 8 p.c. ,,	£23 10 0	7/9
,, 8 p.c. to 10 p.c. ,,	£23 0 0	7/6
,, Specially Refined		
,, Max. 2 p.c. carbon	£42 10 0	16/-
,, ,, 1 p.c. ,,	£52 0 0	17/-
,, ,, 0.75 p.c. carbon	£57 10 0	19/-
,, ,, carbon free	1/5 per lb.	
Metallic Chromium	4/- per lb.	
Ferro Manganese (per ton)	£15 for home, £15 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 10 0 scale 5/- per unit	
,, ,, 75 p.c.	£21 10 0 scale 6/- per unit	
,, Vanadium	17/- per lb	
,, Molybdenum	7/- per lb.	
,, Titanium (carbon free)	1/- per lb.	
Nickel (per ton)	£175	
Cobalt	10/3 per lb.	
Aluminium (per ton)	£130	

FUELS.

SCOTLAND.

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	15/6
,, ,, Ell	16/9
,, ,, Splint	17/6 to 20/6
,, ,, Trebles	14/9
,, ,, Doubles	13/9
,, ,, Singles	13/3
Ayrshire—	
(f.o.b. Ports)—Steam	15/6
,, ,, Splints	17/6
,, ,, Trebles	14/9
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	13/10½ to 16/-
Screened Navigation	22/-
Trebles	15/- to 16/-
Doubles	14/-
Singles	13/3
Lothians—	
(f.o.b. Leith)—Best Steam	15/9
Secondary Steam	15/-
Trebles	16/-
Doubles	14/-
Singles	13/6

ENGLAND.

(8) N.W. Coast—	
Steams	28/-
Household	45/- to 58/4
Coke	28/6
Northumberland—	
Best Steams	17/-
Second Steams	16/6
Steam Smalls	11/-
Unscreened	15/6 to 16/6
Household	23/6 to 25/-
Durham—	
Best Gas	19/6 to 19/9
Second	17/- to 17/3
Household	23/6 to 25/-
Foundry Coke	21/6 to 22/6

Sheffield—	Inland.	
Best Hand-picked Branch	30/- to 33/-	—
Barnsley Best Silkstone	26/- to 28/-	—
Derbyshire Best Brights	28/- to 31/-	—
,, ,, House	24/- to 26/-	—
,, ,, Large Nuts	20/- to 24/-	—
,, ,, Small	14/- to 16/-	—
Yorkshire Hards	18/- to 22/-	—
Derbyshire ,,	18/6 to 22/-	—
Rough Slacks	10/- to 12/6	—
Nutty ,,	8/6 to 10/-	—
Smalls	4/- to 6/6	—
Blast-furnace Coke (Inland)*	—	—
,, ,, (Export)	f.o.b.	21/3 to 22/3

(9) SOUTH WALES.

Cardiff—	
Steam Coals:	
Best Smokeless Large	26/- to 26/6
Second ,,	25/- to 26/-
Best Dry Large	25/- to 25/6
Ordinary Dry Large	23/6 to 24/6
Best Black Vein Large	24/- to 24/6
Western Valley ,,	23/- to 24/-
Best Eastern Valley Large	23/- to 24/-
Ordinary ,, ,,	22/6 to 23/-
Best Steam Smalls	15/6 to 16/-
Ordinary ,,	13/- to 15/-
Washed Nuts	20/- to 28/-
No. 3 Rhondda Large	27/- to 27/6
,, ,, Smalls	17/- to 19/-
No. 2 ,, Large	22/- to 22/6
,, ,, Through	18/- to 20/-
,, ,, Smalls	12/- to 13/6
Foundry Coke (export)	40/- to 47/6
Furnace Coke (export)	25/- to 30/-
Patent Fuel	23/- to 26/3
Pitwood (ex ship)	22/6 to 23/6
Swansea—	
Anthracite Coals:	
Best Big Vein Large	44/- to 46/-
Seconds	38/- to 40/-
Red Vein	29/- to 32/-
Machine-made Cobbles	50/- to 55/-
Nuts	50/- to 55/-
Beans	40/- to 42/6
Peas	22/6 to 23/6
Breaker Duff	9/3 to 9/6
Rubbly Culm	12/- to 12/3
Steam Coals:	
Large	22/- to 24/-
Seconds	21/- to 22/-
Smalls	10/- to 13/-
Cargo Through	16/- to 19/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. * For blast-furnaces only, 16/9, with fluctuations according to analysis; open market, 18/- to 19/- at ovens. † Latest quotations available. (a) Delivered Glasgow. (b) Delivered Sheffield, (c) Delivered Birmingham.

French Engineering Notes.

(From our Correspondent in Paris.)

New Industries.

THE growing industrial activity of many countries which formerly depended upon outside supplies for a great part of their requirements is one of the predominant causes of the changes that have taken place in the conditions of foreign trade. The consuming markets are now manufacturing for their own needs, and some of them are producing a surplus which must be disposed of elsewhere, with the result that there is certain to be an increasingly active competition for foreign trade in the future. New industries had to be created after the war to provide employment for the numerous factories that had sprung up during a period of intense pressure. The collapse of currency values accentuated the necessity of buying as little as possible from countries possessing a more or less normal currency, and most of the continental markets are now purchasing a far smaller quantity of foreign manufactured goods than ever before. A typical case is the extraordinary development of the textile industry following upon the reconstruction of factories in the Roubaix district, which are now equipped with the best and most modern plants. The production everywhere has been steadily increasing, and in all cases there is a growing necessity to find new markets for the disposal of surplus supplies. With improved means of manufacture the French are not overburdened by economic and labour restrictions. Industries are protected in a way that is often regarded as unnecessarily severe. Until recently the fiscal burdens have been comparatively light, and while the labour laws are stringent they are singularly lax in their application, for the reason principally that the French workman, as a rule, prefers to work more hours for the sake of getting more pay. Except for the railwaymen and a few other corporations, the unions have no real power in the land. Under most Governments their political interference is kept firmly in check. It will still be remembered that a Government once broke a railwaymen's strike by mobilising the men. As labour generally refuses to be controlled by unions there is a great adaptability to industrial conditions, and the eight hours' working day is often more honoured in the breach than in the observance, to the extent that men frequently show a preference for shops where they are allowed to work overtime. All this helps the employer to prevent production costs from increasing in inverse ratio to the currency depreciation, and with an increasing output modern plants and a good sales organisation and with the effective co-operation of workmen who are intelligent enough to see that their interests lie in facilitating cheap production, it is possible for manufacturers to reduce prices when necessary to secure foreign business.

Foreign Trade.

The returns of foreign trade during the first three months of the year show a declension in the values of imports and exports as compared with the figures for the corresponding period of 1924. On analysing the returns, however, it is seen that they are far more favourable than could have been anticipated in view of the heavy duties imposed upon French goods imported into Germany since the beginning of the year. If Germany is taking less it is evident that more is being sent to other markets. So far as imports are concerned the total value of 9825 million francs was 391 million francs below the figure for the first three months of 1924. There was a decline in foodstuffs and more particularly in raw material, especially coal. The value of exports totalled 10,920 million francs, a decline of 53 millions; but this was due entirely to foodstuffs, many descriptions of which are not allowed to be exported, and the returns would seem to imply that France is consuming her own agricultural products instead of sending them away and purchasing others to make up for a deficit. There was a notable increase in the values of manufactured goods exported, the total of 6535 million francs being 154 millions more than in the first quarter of last year. Raw material exports amounted to 3035 million francs, an augmentation of 9,420,000f. The increases in manufactured goods were due largely to iron and steel, textiles and motor cars. When studying quantities it is observable that out of a total of 11,440,920 tons of imports raw material was responsible for 10,130,875 tons, and there was a reduction in the total of 1,695,053 tons. The exports amounted to 7,883,111 tons, an increase of 1,304,722 tons. This augmentation was due principally to raw material, which accounted for 6,493,192 tons, while the quantity of manufactured goods sent away was 1,040,251 tons, an increase of 83,517 tons.

The Alsace Canal.

The Commission Centrale pour la Navigation du Rhin is to decide shortly upon which of the two proposals for improving the navigation between Strasburg and Basle is to be adopted, that is to say, the deepening of the river or the construction of the great Alsace Canal, which is intended to serve the double purpose of facilitating the water-borne traffic and of providing hydro-electrical energy to the equivalent of about 785,000 horse-power. The carrying out of the first section to Kembs has been practically settled, although it may be questioned whether it will be actually put in hand in the event of the scheme as a whole being rejected, and there is certainly a violent opposition against it by the Germans as well as by an important section in Switzerland. The French claim is a strong one, because it is based upon the authority granted by the Treaty of Versailles and upon the apparent advantages of a canal which would ensure a more regular and rapid traffic with bigger barges than is possible on the river. The Germans and Swiss argue that it would be much more economical to deepen the Rhine and that the construction of the canal would take many years to accomplish. Even Strasburg hesitates because it fears that the barrage near the Swiss frontier may affect the navigation below that port. The decision of the Commission is therefore being awaited with considerable interest.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics

When an abridgment is not illustrated the Specification is without drawings.

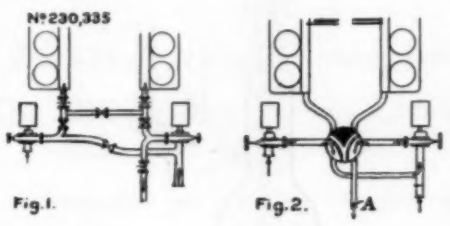
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

230,335. July 4th, 1924.—SCAVENGING BLOWERS, Aktiengesellschaft Brown, Boveri and Cie., Baden, Switzerland.

The inventors propose to employ the centrifugal blowers used on submarines for providing the propelling engines with scavenging air also for the purpose of blowing out the ballast tanks. In the former case the blowers are connected in parallel, but for

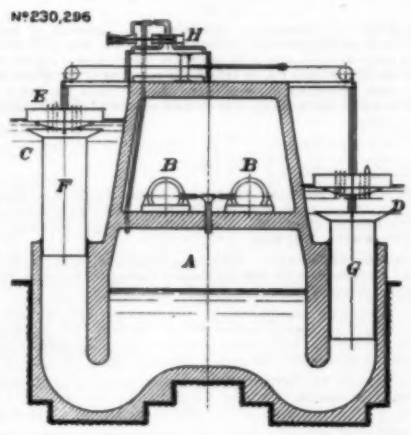


blowing out the tanks they are connected in series. In Fig. 1 the connecting pipes are shown equipped with seven valves, by manipulating which the change-over can be effected. Fig. 2 shows an alterantive arrangement with a single plug cock of special form. In this illustration the two blowers are in series and are delivering air to the ballast tanks by the branch A.—*March 12th*, 1925.

TURBINE MACHINERY.

230,296. April 10th, 1924.—MEANS FOR UTILISING TIDAL ENERGY, J. O. Boving, 110, Victoria-street, London, S.W. 1.

This plant utilises tidal power by compressing air in a chamber A and supplying it to turbines B B. As shown, the water will flow from the pond C to the lower level D, and in doing so will entrain air through pipes in the head E. This air collects in the chamber A and its pressure is dependent on the head of water at D. In order to maintain this pressure constant, regardless of

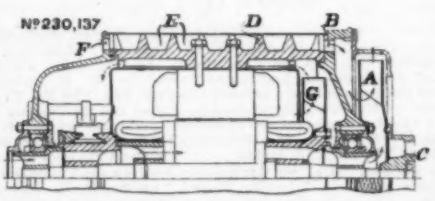


the rise and fall of the tide, the telescoping tubes F and G are connected with a servo-motor H supplied with air from the chamber A. If the air pressure falls the tube F is lowered and then has a larger opening for the water between its top edge and the floating head. The greater quantity of water then flowing entrains more air and the water level in A is depressed, so that the effective head is maintained constant. The apparatus is reversible to work with a falling or rising tide.—*March 12th*, 1925.

DYNAMOS AND MOTORS.

230,137. November 6th, 1923.—IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, George Herbert Fletcher, of 22, Glentill-road, Ecclesall, Sheffield, and the Metropolitan-Vickers Electrical Company, 4, Central-buildings, Westminster.

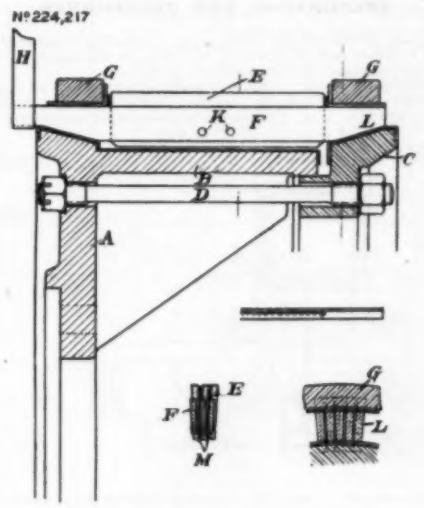
The working parts of the motor described in this specification, such as the field magnets and armature windings, the brush gear and co-operating rotating parts and the rotor bearings are



completely enclosed by means of end bells or other encasing members. The object of the invention is to provide an improved air-cooling system for such machines, wherein efficient cooling may be obtained without the admission of air from the exterior to the enclosed working parts. In the case of the particular arrangement illustrated, the cooling air is drawn through the rotor and jacket in parallel. The fan A draws air through the openings B in the jacket and from the passages C in the rotor, the directions of the air currents being as indicated by the arrows In addition to the fan A there is also an auxiliary fan G. By reason of the helical ridge or thread D, the air channel E is long, and offers an extended cooling surface and a restricted path for the air, resulting in a high velocity. The air inlet for the jacket space is shown at F.—*March 6th*, 1925.

224,217. October 18th, 1924.—IMPROVEMENTS IN OR RELATING TO COMMUTATORS FOR ELECTRIC MACHINES, Siemens-Schuckertwerke Gesellschaft mit beschrankter Hafting, of Siemensstadt, near Berlin.

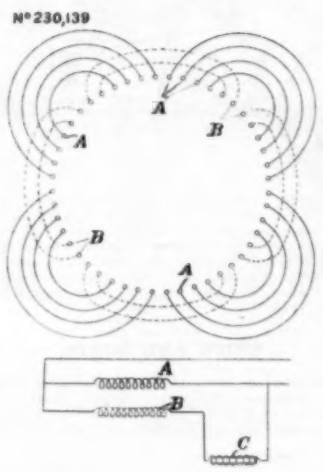
Thie invention aims at eliminating the injurious effects produced in commutators of the usual construction by the expansion of the copper segments owing to the segments becoming cooled in an unequal manner, and at different movements. The iron body of the commutator intended to receive the segments is constituted by a hub ring A, with a wide annular flange B, and a clamping ring C guided in the latter and secured to the hub by means of screw bolts D. Owing to this construction, a certain amount of axial expansion of the commutator is taken



up. In order to equalise the radial expansion of the commutator, the segments E are supported by iron bars F, which are secured to the commutator body by shrink rings G and carry the lugs H. The copper segments E are so dimensioned and mounted on the iron bars F that when heated they can expand in the space between the two shrink rings independently of the iron bars, which are let into or imbedded in the copper segments E, and are surrounded by the latter on three sides. The copper and iron bars are connected togother in the centre by means of rivets K. The ends L of the iron bars, which project beyond the copper, are thickened so that a small space is left between the segments and the insulating bars M for equalising the expansion of the copper in the circumferential direction of the commutator.—*March 12th*, 1925.

230,139. November 7th, 1923.—IMPROVEMENTS IN OR RELATING TO INDUCTION MOTORS, J. Lyons and Co., Ltd., of Cadby Hall, Kensington, W. 14, and Arthur George Goddard, of "Westholme," 46, Rancliffe-road, East Ham, E. 6.

This specification describes an improved single-phase induction motor, which is self-starting under full load. The main



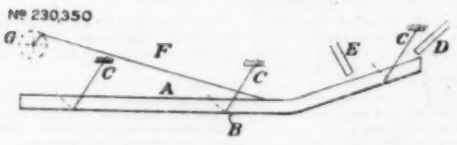
stator windings are shown at A, and a parallel connected winding at B. In series with the latter an inductance C is connected. The direction of running is reversed by reversing the current in one of the windings, the turns of which being in the ratio of 5 to 8 or 7 to 8.—*March 9th*, 1925.

MINING MACHINERY.

230,350. August 12th, 1924.—DE-WATERING COAL SLIMES, R. R. Minikin, Brades House, Oldbury, near Birmingham; and Nortons (Tividale), Ltd., Hecla Works, Tipton, Staffs.

The object of this invention is to improve the percentage of water removed from slimes and small coal which are produced in the operation of the ordinary coal washing plants. It is the common practice to pass these small coal particles and slimes over fixed and vibrating screens of fine mesh wedge wire to extract the water from the wet material. The vibrating screens take the form of horizontal trays supported by inclined wood hangers or springs. In this invention the fixed sieves are dispensed with and the slimes and fine coal are delivered simultaneously upon a specially formed vibrating tray, in which the receiving end is inclined upward away from a horizontal portion. In the accompanying drawing A is the frame of a horizontal vibrating tray which has the back end tilted up at a suitable angle. Supported by this frame is a fine-mesh wedge wire screen B, which is also bent or tilted up at the back end. A flushing trough D delivers the fine or small coal upon the tip of the inclined portion of the wedge wire screen, and E is a liquid slime trough which delivers

the slime upon the partially dried coal sliding down the inclined surface to the horizontal portion. The frame A is supported by the inclined hangers C, and the connecting-rod F is operated by the crank shaft G. The inclined vibrating surface of the screen

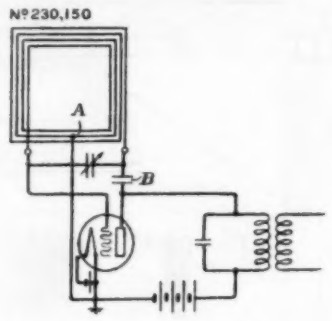


causes a rapid preliminary de-watering and facilitates the filtering action of the small coal at the point where the slime is delivered on to it.—*March 12th*, 1925.

TELEGRAPHS AND TELEPHONES.

230,150. November 29th, 1923.—Improvements in Electrical Wave-receiving Systems, The Western Electric Company, of Connaught House, Aldwych, W.C. 2.

According to this invention, a point in a frame aerial is connected to a point at earth potential, and a condenser having a capacity of the same order as the inherent capacity between the

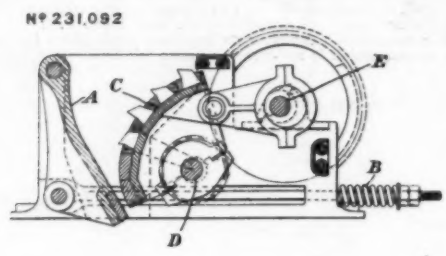


anode and grid of the valve, is placed between the anode circuit and one end of the frame aerial. With this arrangement, the directional selectivity is increased. The circuit is said to be highly selective. It will permit of high amplification of the received signal, and is capable of being used efficiently by unskilled persons.—*March 2nd*, 1925.

CRUSHING AND GRINDING.

231,092. October 15th, 1924.—Rock Crushers, P. Phelps, 411, Fifteenth-avenue, Columbus, Ohio.

This specification includes, among others, the illustration reproduced herewith, but is phrased in such terms that it is virtually impossible to discover the object aimed at—except that a "relief of pressure" is obtained. The mechanism is, however, obviously novel for the purpose. There is a plain crusher plate A, the resistance of which appears to be controlled

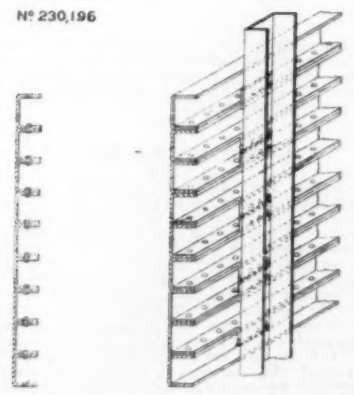


by the spring B. The moving crushing jaw C is "arcuate" in form, and is mounted on an excentric D, while it is given an oscillating movement by the connecting-rod and excentric E. It seems that the upper excentric E must give a sort of feeding and shearing action to the upper part of the crushing jaw C, while the lower excentric D provides a direct crushing action, and, presumably, the relief of pressure already referred to.—*March 26th*, 1925.

SHIPS AND BOATS.

230,196. December 13th, 1923.—Hulls of Flying Boats, S. E. Saunders, Columbine Works, Medina-road, East Cowes, Isle of Wight.

In this specification claim is made for "a boat hull or body or

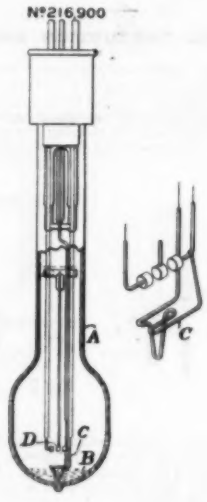


analogous structure comprising a series of strips of channel or U section, placed side by side, with the flanges of adjacent strips in contact and connected together, the said strips extending longitudinally of the structure and being strengthened by internal cross frames and narrowed or tapered in width where the surface of the hull or body becomes reduced, the said flanges being on one side of the structure." The drawing is self-explanatory.—*March 12th*, 1925.

LIGHTING AND HEATING.

216,900. June 2nd, 1924.—Improvements in and relating to Arc Lamps, *The British Thomson-Houston Company, Crown House, Aldwych.*

The arc lamp described in this specification consists of an elongated glass receptacle A, containing electrodes arranged as shown. Adjacent to the electrodes is a pool of mercury B. The bulb also contains an inert gas, such as argon. A wire loop C



dips into the mercury and is connected in circuit with one of the electrodes. When this wire is heated to incandescence, ionised vapour is produced and an arc may be started between the main electrodes with facility. D is a refractory body, which acts as a "glower." The object of the invention is to produce a lamp of high efficiency and which will emit a substantially white light.—*March 12th*, 1925.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.

TO-DAY.

Institute of Metals: Sheffield Local Section.—Mappin Hall, Department of Applied Science, The University, St. George's-square, Sheffield. Paper, "Chromium Plating," by Mr. Byron Carr. 7.30 p.m.

Institute of Metals: Swansea Local Section.—Metallurgical Department of the University College, Singleton Park, Swansea. Annual general meeting. 7.15 p.m.

Institution of Aeronautical Engineers.—The Engineers' Club, Coventry-street, London, W. 1. Lecture "The Position of the Airship in Aerial Transport," by Commander C. D. Burney. 6.30 p.m.

Institution of Engineering Inspection.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "The Evolution of Steam Boilers," by Mr. T. Clarkson. 7.45 p.m.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, London, S.W. 1. Reports to the Hardness Tests Research Committee. "The Effects of Adhesion between the Indenting Tool and the Material in Ball and Cone Indentation Hardness Tests," by Mr. G. A. Hankins; and "Some Practical Aspects of the Scratch Test for Hardness," by Mr. G. A. Shires. 6 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. Lecturette, "The Manufacture of Gramophone Records," by Mr. H. E. Cowley. 7.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Lecture Theatre of the Literary and Philosophical Society, Newcastle-upon-Tyne. "Gas Turbines," by Mr. M. König. 7.30 p.m.

Physical Society of London.—Imperial College of Science, South Kensington, London, S.W. 7. Tenth Guthrie Lecture. "Recent Researches in Positive Rays," by Professor W. Wien. 5 p.m.

Royal Institution of Great Britain.—21, Albemarle-street, London, W. 1. Discourse, "The Icelandic Sagas," by Professor W. A. Craigie. 9 p.m.

MONDAY, APRIL 27th.

Faraday Society.—Chemical Society's Rooms, Burlington House, Piccadilly, London, W. 1. Papers: "Adhesion of Deposited Nickel to the Base Metal," by Mr. A. E. Ollard; "The Brittleness of Zinc-plated Steel," by Mr. H. Sutton; "The Partition of Silver between Lead and Zinc," by Mr. W. A. Naish; "The Elasticity of Gelatin Jellies and its Bearing on their Physical Structure and Chemical Equilibria," by Mr. H. J. Poole; "A Note on the Reduction Potential of Dicyanquinhydrone," by Mr. E. K. Rideal; (i.) "On Some Physical Properties of Water," (ii.) "On the Relation between the Viscosities of Liquids and their Molecular Weight," by Mr. D. B. Macleod. 8 p.m.

Institution of Automobile Engineers: Scottish Centre.—Royal Technical College, Glasgow. Paper, "The Accessibility of the Pleasure Car Chassis," by Mr. M. Platt. 7.30 p.m.

Institution of Mechanical Engineers: Graduates Section.—Storey's-gate, Westminster, London, S.W. 1. Exhibition of Industrial Kinematograph Films. 7 p.m.

Royal Society of Arts.—John-street, Adelphi, London, W.C. 2. Howard Lecture, "Motor Fuels—II.," by Professor John S. S. Brame. 8 p.m.

MONDAY TO SATURDAY, APRIL 27th TO MAY 2nd.

Local Industries Exhibition.—At Drill Hall, Church-hill, Walthamstow, London, E. 17. 10.30 a.m. each day.

TUESDAY, APRIL 28th.

Institute of Marine Engineers.—85–88, The Minories, Tower-hill, London, E. 1. "Steam Accumulation," by Mr. D. M. Proctor. 6.30 p.m.

Institute of Metals: North-East Coast Local Section.—Electrical Engineering Theatre, Armstrong College, Newcastle-on-Tyne. Annual general meeting. 7.30 p.m.

Institution of Automobile Engineers.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "The Accessibility of the Pleasure Car Chassis," by Mr. M. Platt. 7 p.m.

Institution of Electrical Engineers: North Midland Centre.—Hotel Metropole, King-street, Leeds. Annual general meeting and smoking concert. 6.45 p.m.

WEDNESDAY, APRIL 29th.

Institute of Physics.—Royal Society's Rooms, Burlington House, Piccadilly, London, W. 1. Lecture, "Physics in the Rubber Industry, with special reference to Tire Manufacture," by Dr. W. Makower. 5.30 p.m.

THURSDAY, APRIL 30th.

Institution of Civil Engineers: Birmingham and District Association.—Chamber of Commerce, New-street, Birmingham. Annual general meeting. 6 p.m.

Institution of Civil Engineers: Yorkshire Association.—Griffin Hotel, Boar-lane, Leeds. Paper, "The Centrifugal Pumping Machinery at Knostrop Sewage Works, Leeds," by the President, Mr. G. A. Hart. 7.30 p.m.

Institution of Locomotive Engineers.—The Engineers' Club, Coventry-street, London, W. 1. "Poppet Valve Gears," by Ing. A. Caprotti. 7 p.m.

Royal Aeronautical Society.—7, Albemarle-street, London, W. 1. Thirteenth Wilbur Wright Lecture. "Some Aspects of the Comparison of Model and Full-scale Tests," by Rear-Admiral D. W. Taylor. 8.30 p.m.

Women's Electrical Association.—E.L.M.A. Lighting Service Bureau, 15, Savoy-street, Strand, London, W.C. 2. "Modern Lighting Methods," by Mr. W. E. Bush. 6.15 p.m.

FRIDAY, MAY 1st.

Faraday House Old Students' Association.—Prince's Hall, Hotel Cecil, London, W.C. 2. Annual smoking concert. 8 p.m.

Institute of Cost and Works Accountants.—Hotel Great Central, Marylebone-road, London, N.W. Fourth annual Costing Conference. 10.30 a.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. Lecturette, "Pumps and Pumping Problems," by Mr. A. A. Fairfax. 7.30 p.m.

Royal Institution of Great Britain.—21, Albemarle-street, London, W. 1. Annual meeting. 5 p.m.

Royal Institution of Great Britain.—21, Albemarle-street, London, W. 1. Discourse, "Crystalline Structure of Inorganic Salts," by Professor W. L. Bragg. 9 p.m.

MONDAY, MAY 4th.

Royal College of Science Association.—Chemical Lecture Theatre of the Royal College of Science, Exhibition-road, London, S.W. 7. Huxley Lecture, "Thomas Henry Huxley," by Professor E. B. Poulton. 5 p.m.

Royal Society of Arts.—John-street, Adelphi, London, W.C. 2. Howard Lecture. "Motor Fuels—III.," by Professor J. S. S. Brame. 8 p.m.

WEDNESDAY, MAY 6th.

Institute of Metals.—Institution of Mechanical Engineers, Storey's Gate, Westminster, London, S.W. 1. Fifteenth Annual May Lecture on "The Motion of Electricity in Metals," by Professor Dr. H. A. Lorentz. 8 p.m.

Royal Society of Arts.—John-street, Adelphi, London, W.C. 2. "Commercial Aviation," by Air Vice-Marshal Sir W. Sefton Brancker. 8 p.m.

THURSDAY AND FRIDAY, MAY 7th AND 8th.

Iron and Steel Institute.—Institution of Civil Engineers, Great George-street, London, S.W. 1. Annual meeting. For programme, see page 411. 10 a.m. each day.

FRIDAY, MAY 8th.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, London, S.W. 1. Fourth Report of the Steam Nozzles Research Committee. 6 p.m.

Institution of Municipal and County Engineers.—South Wales District meeting. 1.30 p.m.

Annual Staff Dinner.—On Friday, April 3rd, Delco-Remy and Hyatt, Ltd., held their annual staff dinner at the Holborn Restaurant. It was the first gathering of its kind since the amalgamation of Delco-Remy, Ltd., and Hyatt, Ltd., which took place in October last, and was, in every way, a success. In the course of the evening it was stated that the company had now acquired extensive offices and works, occupying some 30,000 odd square feet, at 111, Grosvenor-road, London, S.W. 1, this being the actual outcome of the amalgamation.

Busk Studentship in Aeronautics.—The trustees hope to make an appointment towards the beginning of July next. The object of the Busk Studentship, which was established in memory of Edward Teshmaker Busk, who lost his life in 1914 while flying the first stable aeroplane, is to enable the holder to engage in research, or preparation for research in aeronautics and specially in those subjects such as stability problems, meteorological questions bearing on flight, or the investigation of gusts, treated either experimentally or mathematically, in which Edward Busk was specially interested. The student will be expected to devote his whole time to research on a subject approved by the trustees, and at the close of his studentship to make to them and to the University of Cambridge a report on his work. The studentship is of the value of about £150, tenable for one year from October 1st; but a student may be re-appointed on the same terms for a second year. It is open to any man or woman being a British subject and of British descent who had not attained the age of twenty-five years on October 1st, 1924. Forms of application for the studentship can be obtained from Professor B. M. Jones, Engineering Laboratory, Cambridge, and must be filled up and returned to him not later than May 12th, 1925.